# American Machinist

FEBRUARY 10, 1949

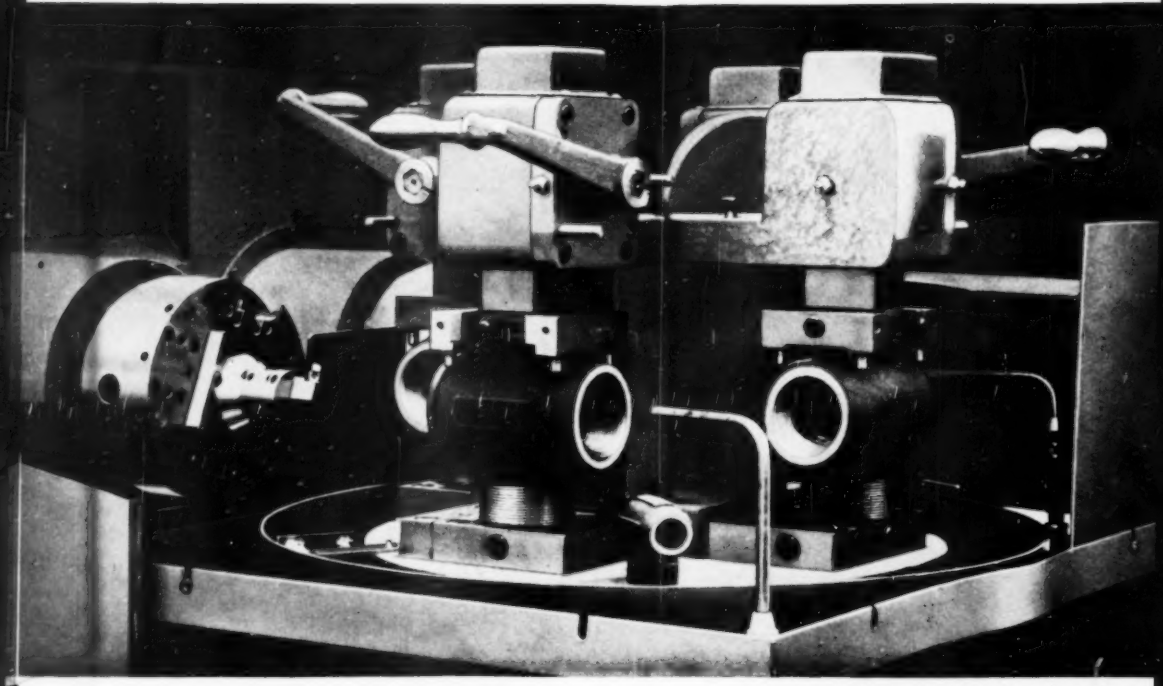
Caterpillar crankshafts finished in 1.5 min. to 5 micro-inches RMS—*see page 2*

**How to Machine Beryllium Copper**—A SPECIAL REPORT

**Carbide Dies Set Production Records**

**How to Bore to Ultra-close Tolerances**

# This ONE Heald Bore-Matic now does the work of four older machines



This single-end Heald Bore-Matic (above) handles two different sizes of steel valve bodies. Parts are held in a rotary indexing fixture.

## ...borizing 65000 valve bodies without a single reject!

Before the installation of this single-end Heald Bore-Matic, a large valve manufacturer had to use four machines for borizing of valve bodies. Now the entire job is done on the one Heald machine—faster, easier, and with greater precision.

Over a three-month period, this machine turned out 65000 parts without a single reject traceable to the machine. And higher production speed permits the manufacturer to fill rush orders without having to maintain a heavy inventory of finished parts.

**Savings like this are typical** of what Heald machines are doing every day, in practically every type of industry. Chances are there's a Heald machine that can do as much—or more—for you. Your nearest Heald representative, or our engineers here at Worcester, will be glad to confer with you.

HEALD

**THE HEALD MACHINE COMPANY**
**Worcester 6, Mass.**

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# American Machinist

MAGAZINE OF METALWORKING PRODUCTION



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# Clips & Quips

***Our Cover*** . . . Three special crankshaft Superfinishers have been built for Caterpillar Tractor Co., Peoria, Ill., by Gisholt Machine Company. Our cover Kodachrome shows one under test—with the characteristic yellow "Cat" shaft showing prominently.

The crankshaft is loaded into the machine and the individual arms hydraulically clamped to the corresponding pin bearings. When the cycle is started, the crankshaft rotates slowly on its own centers and oscillates at the same time. The arms follow the pins around their own orbits. Four Superfinishing stones on each arm lap away surface irregularities, while the special lubricant flushes off removed particles. The six pin bearings are simultaneously brought to a surface finish of less than 5 microinches RMS in 1.5 min.

The machine is especially adapted so all adjustments are variable. Thus it is now used on a number of different crankshafts and can be adapted to any designs without retooling or unnecessary production delays.

***B. C.*** . . . Beryllium copper has become a familiar metal in recent years, so we felt you'd want the latest on how to machine it. When we got the details, we were surprised to find it took a full-fledged 16-page Report to bring them to you. But here they are, authoritatively.

***Olds Engine*** . . . The new Oldsmobile engine plant (our cover, Jan. 27) is radically different in many respects, including methods. We've had Chester Ricker picking out the most useful ones for several months, and present in this issue the first of three articles high-spotting them.

***On the Fence*** . . . Recently, a reader told us vehemently that we had too much fundamental data on Metalworking, not enough specific case-study material. By coincidence, another reader in the same kind of job (works manager) said, just as vehemently, the exact reverse. While we detest fence-walkers in most cases, it's a gratifying feeling to hear it confirmed about our editorial content.

***Authority*** . . . Research in Metalworking keeps turning up very useful data. . . . This issue includes two such, one on boring to high accuracy in a lathe, the other on milling. Both are short, give you the meat without the usual lecture.

***Accolades*** . . . Our Special Reports continue to generate a good deal of correspondence that warms the cockles of editorial hearts these snowy days . . . Among recent ones is a letter from the "chief buyer" for Garrard Engrg. & Mfg. in Swindon, England, the company that makes top-flight record changers. He says it's the company custom to give our "The Tools of Our Trade" to each new apprentice and orders 200 copies . . . Then E. Clark Woodward, director of Safety at A. O. Smith, calls our recent report on Safety Equipt. a "very interesting document."

***Orchids*** . . . David Lopez of Approved Devices Company writes that our Shop Equipment News description of his new cut-off machine drew "inquiries from all over the United States, from foreign countries such as England, Norway, Finland, Switzerland, Germany, Mexico, Central America, Canada, and South America, as well as from import and export firms in New York. It has indeed been profitable because we have sold machines through these inquiries. . . ." Our reason for mentioning it, beyond pure satisfaction, is that this description quoted the price—something once promotionally "verboten". . . . For balance, P. Wright, owner of Wright & Co., mentioned in the same mail that a "Talented Tooling" item in Dec. 2 *A.M.* saved him a possible $100.

***Coming*** . . . Feb. 24 *A.M.* will, for a change, include many short articles. The Special Report will provide shop tests for identifying steels, the lead article will describe fixtures and methods for broaching "unmachinable" jet-turbine parts. Other articles will deal with spinning tube ends, form grinding, wrinkle finish, and counterbores. There are also three press articles, one on determining blank diameters, another on a progressive blank-and-form die and the third on deep-drawing aluminum tubs.

**CARBIDE DIE MAN** . . . A. Earle Glen has for a number of years been a regular source for articles on new applications of tungsten carbide. You may recall recent data on carbide dies that came from his pen. Herewith is his roundup of performance by recent carbide dies.

Mr. Glen has been with Carboloy Company, Inc., since 1928, shortly after its founding, and was responsible for many of the pioneer carbide-die installations in wire mills. He has been successively die service engineer and manager of die sales, first in the Pittsburgh district and then nationally. He is an active member of the Wire Association.

# *For Producing*
# SMALL BEVEL GEARS

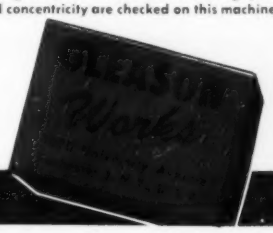
Whether you need small spiral bevel, Zerol bevel, hypoid gears or Curvic clutches, the new Gleason No. 2 Hypoid Generator is capable of producing it. This versatile generator, rigidly constructed and featuring closer control of actual cutting, faster speeds and a superior tooth bearing is the last word in equipment for the manfacture of small bevel gears.

## GLEASON No. 7
## Hypoid Cutter Sharpeners

① As a necessary supplement to the cutting machinery the Gleason No. 7 Hypoid Cutter Sharpener provides a simple, economical means for sharpening the multi-blade circular cutters used in the No. 2 Hypoid Generator. This machine is a wet-type sharpener capable of producing a high quality cutting edge and finish on the cutters, thus providing a smooth surface finish in the cut gears.

## GLEASON No. 4
## Angular Bevel Tester

② The Gleason No. 4 Anguar Bevel Tester can be used to either hand roll or power test bevel gears cut on this machine. Rolling qualities, tooth spacing and concentricity are checked on this machine.



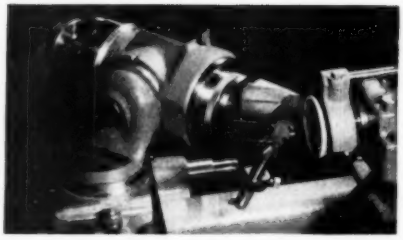

*Builders of Bevel Gear Machinery for Over Eighty Years*

# CINCINNATI NO. 2 CUTTER GRINDER

## *Sharpens a wide variety of cutters*

CINCINNATI No. 2 Cutter and Tool Grinder sharpening a large taper reamer.

If you use a variety of cutters in your shop, there's no better machine to sharpen them correctly than a CINCINNATI No. 2 Cutter and Tool Grinder. This machine has many features, and extra attachments, too, for sharpening an exceptionally wide variety of cutters. Three extremes are shown here: a large taper reamer, a lathe tool, and a shell end mill. Cincinnati's sensitive antifriction table traverse is highly desirable for all of these jobs, and its rugged construction is an absolute necessity for heavy parts like the large taper reamer. Other features provide the flexibility required for sharpening face mills, slab mills, interlocking cutters, taps, planer and shaper tools, etc. Write for catalog M-1618-1. It contains complete information on this versatile cutter and tool grinder. And if you would like to have tables and charts for the correct sharpening of cutters, ask for our new booklet "Look Sharp at Your Cutters," M-1657.



Sharpening the corner of a shell end mill on a CINCINNATI No. 2 Cutter and Tool Grinder.

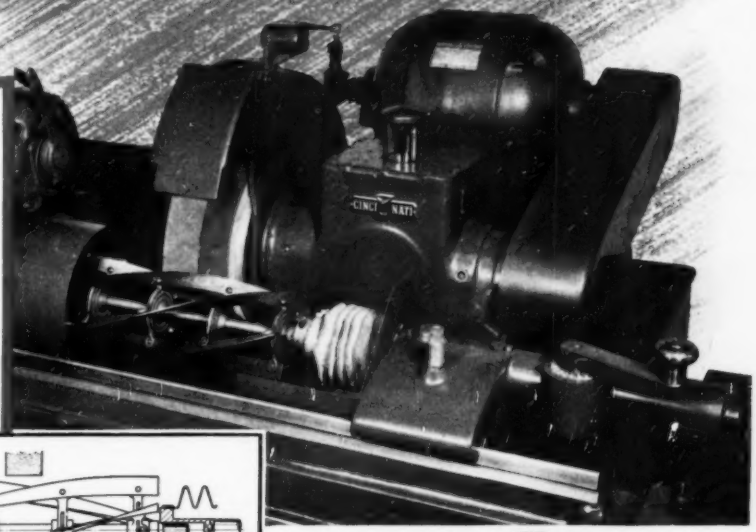
Sharpening a lathe tool on a CINCINNATI No. 2 Cutter and Tool Grinder.

THE CINCINNATI MILLING MACHINE CO.

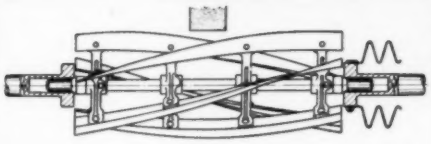
CINCINNATI 9, OHIO, U. S. A.

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

# New Lawn Mowers hum a smooth cutting tune with reels precision ground on a CINCINNATI



Several sizes of lawn mower reels are ground on this CINCINNATI 10"-L x 30" Plain Hydraulic Grinding Machine. The footstock has 4" spindle retraction for the purpose of supporting the reel on its bearing cones between female centers. Production varies up to 75 per hour, removing .010" stock for the finish grinding operation.



Drawing of reels supported between centers.

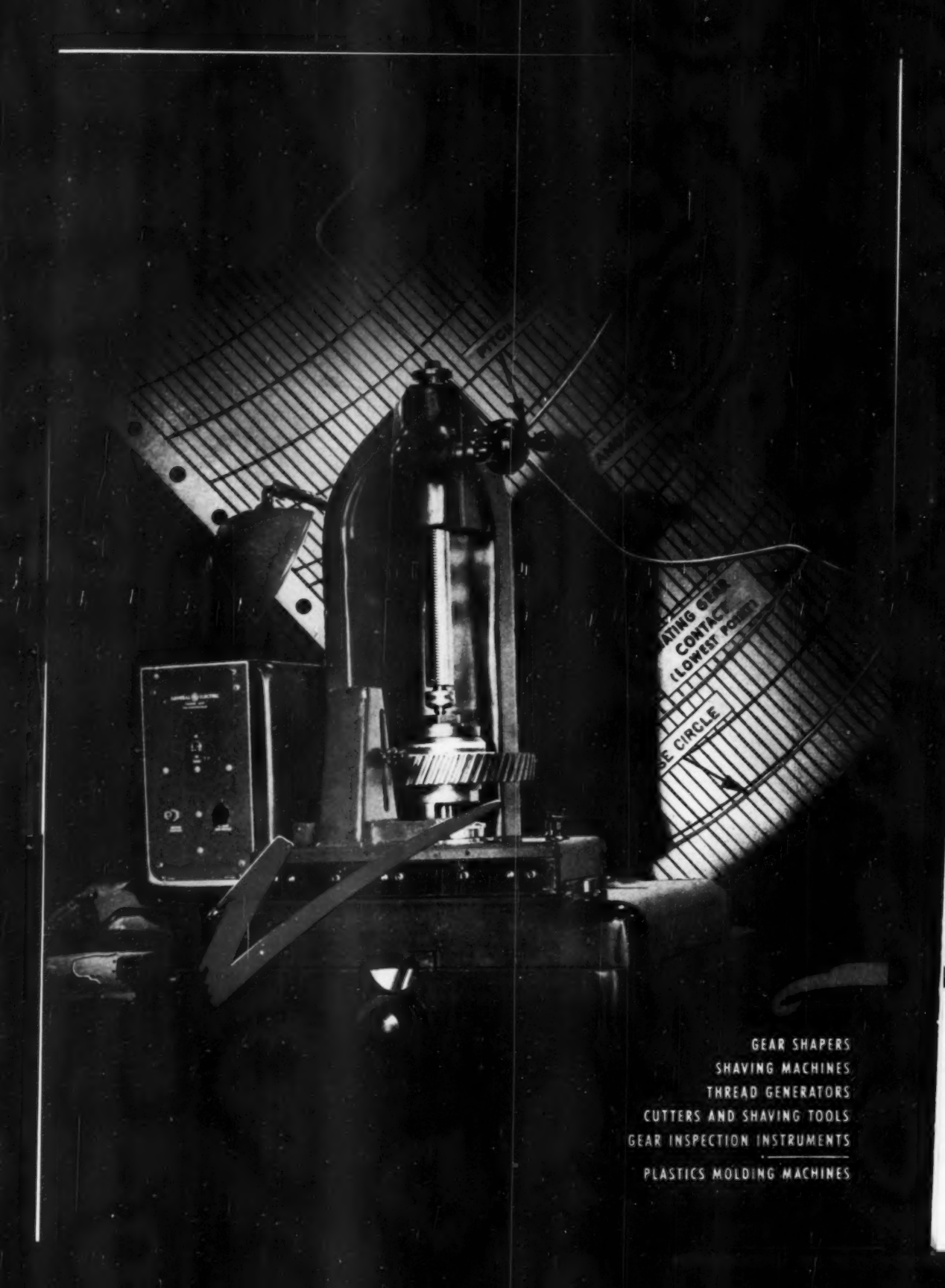
CINCINNATI 10" Plain Hydraulic Grinding Machine. Complete specifications may be obtained by writing for catalog G-566.

One of the reasons why your new lawn mower will cut grass so smoothly is because the reel is now precision ground. Large manufacturers have chosen CINCINNATI 10"-L Plain Hydraulics for the job, because these machines are just the right size and power for this type of work . . . or for any work requiring 10" swing with the power of a 6" machine. And they have many features of dependable, low cost performance. FILMATIC spindle bearings—found only in CINCINNATI Grinding Machines—and automatic filtered lubrication are big factors of Cincinnati dependability. Unit type construction keeps down maintenance expense. Other features are described in an attractive catalog. Write for a copy.

## CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES




GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

# GEAR INSPECTION that accepts broad-shouldered responsibility

Recorded charts of each gear inspection operation, automatically produced by these Inspection Instruments, are the fundamental safeguard. The vagaries of the human element are minimized to the "Nth" degree. The charts are permanent and can be filed for future reference.

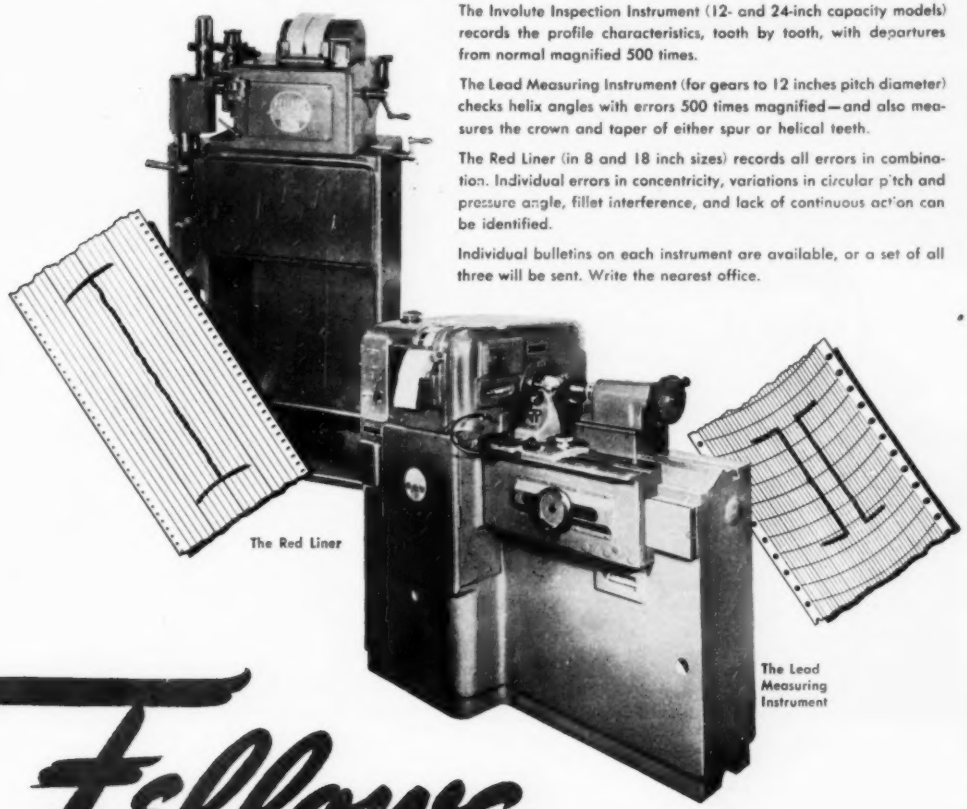
The operating accuracy of each of the Instruments is a known quantity; checked and rechecked at any time by reference to a master gauge or gear, which is part of the regular equipment. While the inspection of external gears is pictured here, standard equipment provides for checking internal gears as well.

The Involute Inspection Instrument (12- and 24-inch capacity models) records the profile characteristics, tooth by tooth, with departures from normal magnified 500 times.

The Lead Measuring Instrument (for gears to 12 inches pitch diameter) checks helix angles with errors 500 times magnified—and also measures the crown and taper of either spur or helical teeth.

The Red Liner (in 8 and 18 inch sizes) records all errors in combination. Individual errors in concentricity, variations in circular pitch and pressure angle, fillet interference, and lack of continuous action can be identified.

Individual bulletins on each instrument are available, or a set of all three will be sent. Write the nearest office.



The Red Liner

The Lead Measuring Instrument

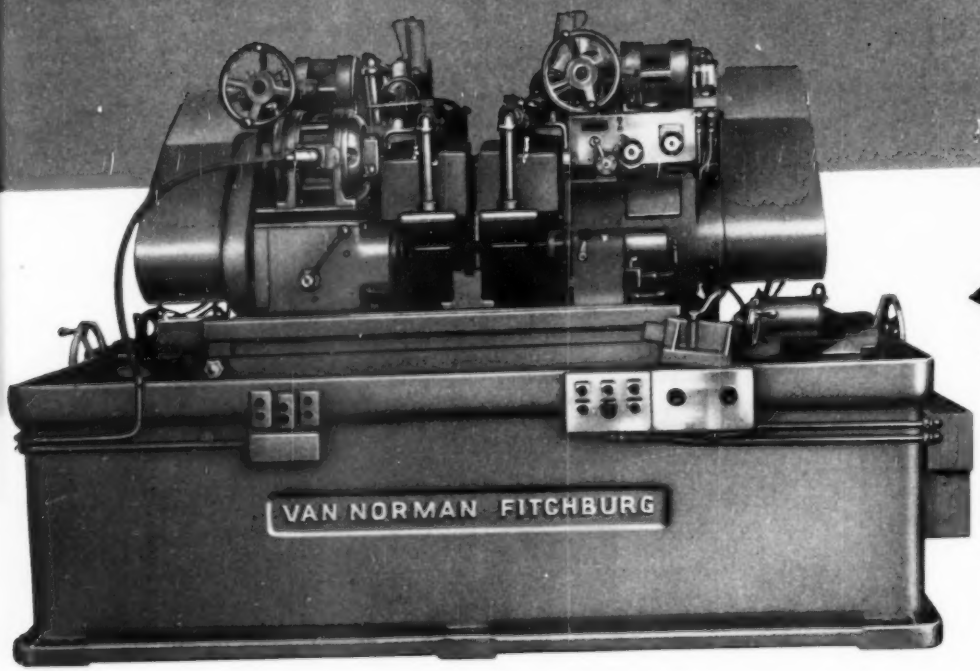
*Fellows*

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont.

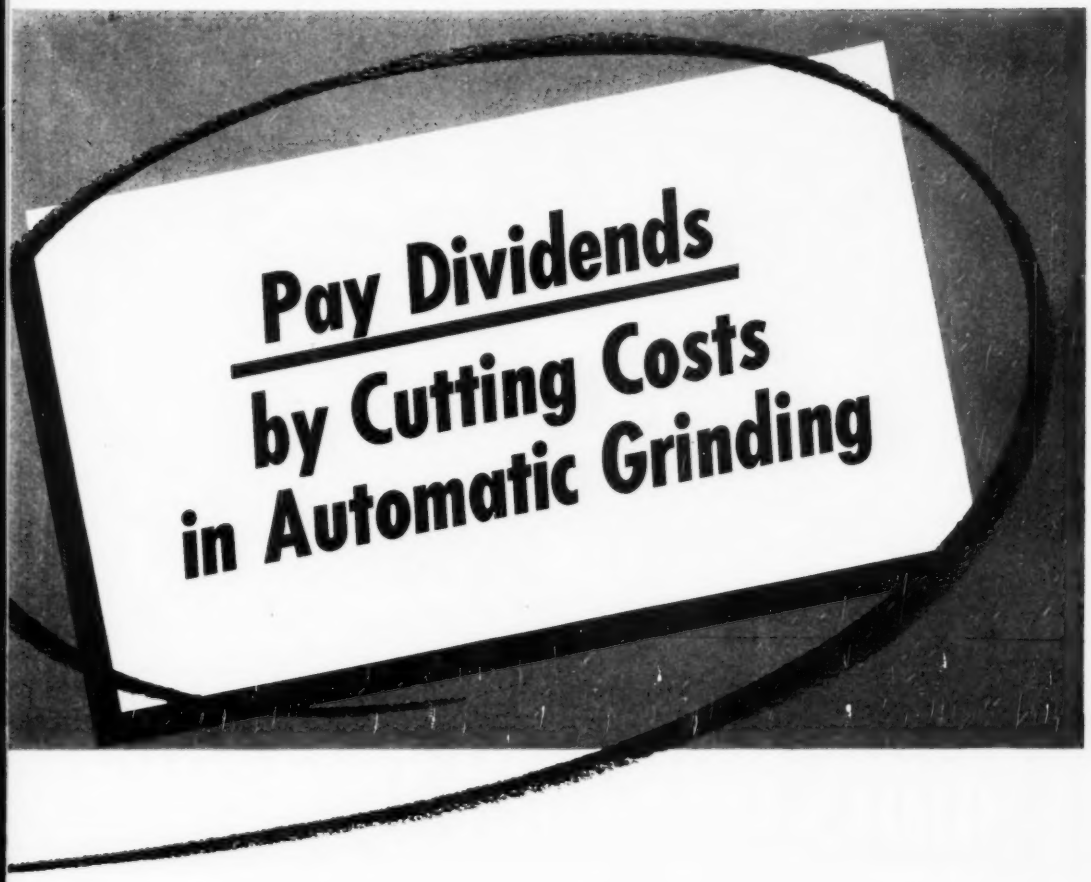
Branch Offices: 616 Fisher Bldg., Detroit 2 • 640 West Town Office Bldg., Chicago 12 • 7706 Empire State Bldg., New York 1

# Van Norman Fitchburg

## CYLINDRICAL GRINDERS




*"It pays to Van Normanize"*

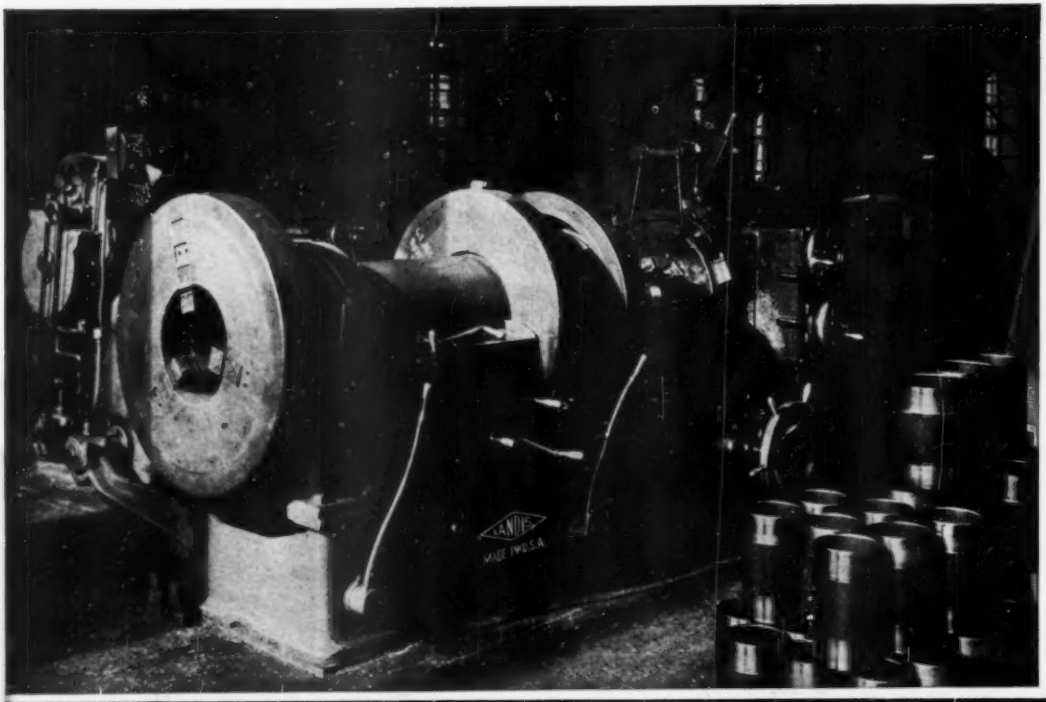



You can't beat Van Norman-Fitchburg Cylindrical Grinders for cutting costs in automatic mass-production grinding. These specially designed grinders reduce tooling costs . . . enable you to produce more at the lowest possible "cost-per-piece."

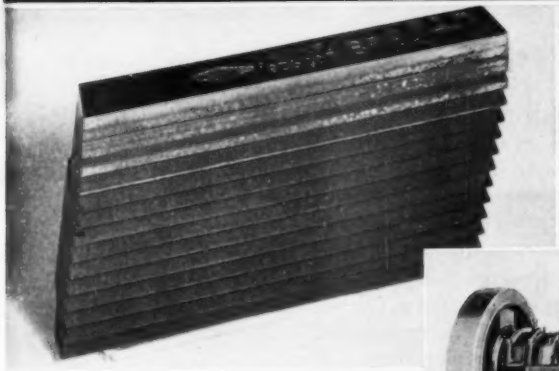
For special jobs, Van Norman will design and build special purpose grinders to fit your needs. All we have to do is simply take one or more Van Norman-Fitchburg Bowgage Wheelheads . . . completely automatic integral grinding units with gauging, rough and finish feeds and automatic cycling complete with rapid traverse . . . and mount them on a base best suited to meet your jobs.

Whether it is a Standard or Special Purpose Machine, it will pay you to investigate the Van Norman-Fitchburg Cylindrical Grinders. Other Van Norman-Fitchburg machines are Angular Head Grinders, Spline and Gear Grinders, Consta-Contact Grinders and Bowgage Wheelheads. Write for information.

**VAN NORMAN COMPANY**
**SPRINGFIELD 7, MASSACHUSETTS**

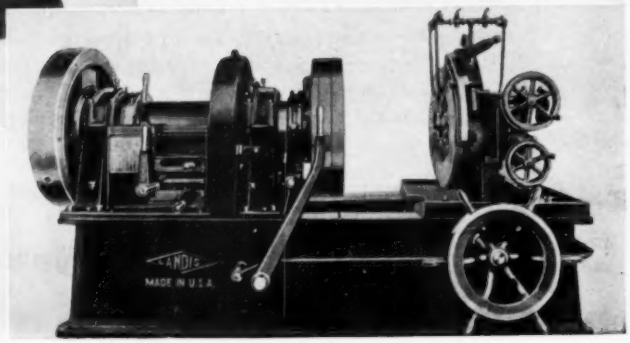



# LANDIS MACHINE COMPANY



Landis Tangential Pipe Chasers employed in Stationary Head—one set chasers required to cover range of die head—eliminates the changing of chasers for each diameter of threads produced—assuring accurately formed threads and low threading cost.

The Landis Stationary Die Heads applied to our Pipe Threading and Cutting Off Machines minimize spoilage—insure high degree concentricity due to floating action of die head in T-slot of cross rail.



*Accurate-Time Saving-Flexible*

# LANDIS PIPE THREADING AND CUTTING OFF MACHINES

Saves time—cuts cost—insures accuracy—in the production of pipe threads.
For heavy duty, continuous service—built in nine different sizes ranging from 2" to 20" inclusive.

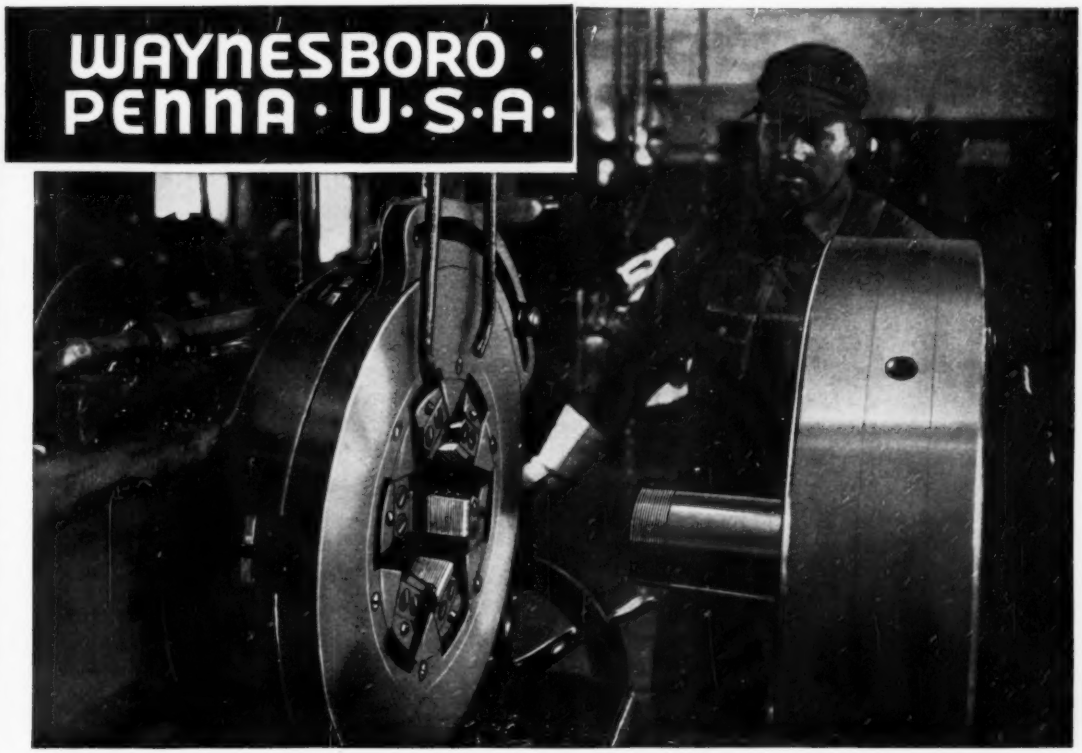
Designed for flexibility in threading all diameters of pipe within their range.

Employs eight speed selective type gear box with cut steel gears—operating in continuous bath of oil—having reversing control.

Front and rear chucks fitted with renewable rocket type grip inserts, replaceable at minimum cost. Gripping chucks with universal adjustment on 2" to 12" machines.

Here's the Pipe Threading and Cutting Off Machine you will find a profitable investment for production, jobbing, and maintenance pipe threading operations.

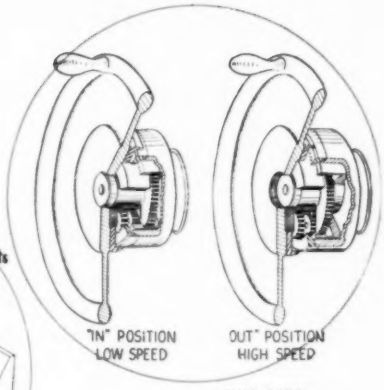
***Write for complete information***



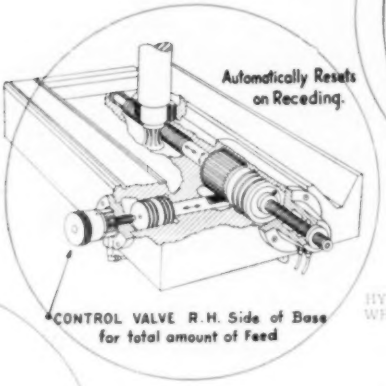
# for Precision Grinding Results

straight cylindrical / taper / shoulder / profile

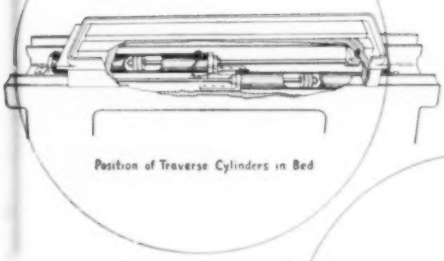
## these outstanding design features




TWO SPEED
HAND TRAVERSE

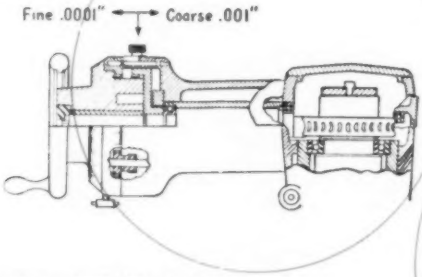



HYDRAULIC
WHEEL FEED

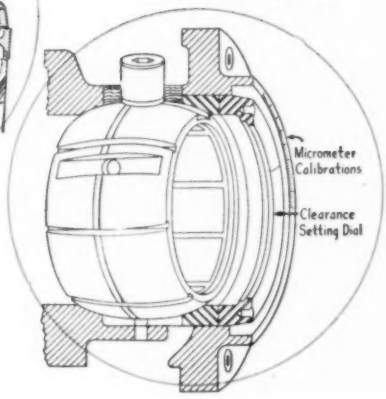



HYDRAULIC TABLE
TRAVERSE

HAND AND AUTOMATIC
WHEEL FEED




MICROSPHERE WHEEL
SPINDLE BEARINGS




# LANDIS TOOL

*Precision Grinders*

# in Job Shop - Tool Room - Volume Production

low unit cost / fine finishes / close tolerances

4" Type H

## LANDIS TOOL plain hydraulic grinders

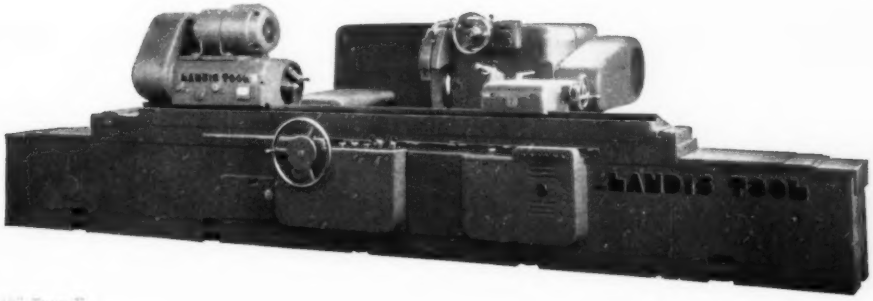
10"—14" Type CH

### check the features

| | TWO SPEED HAND TRAVERSE | *HYDRAULIC WHEEL FEED | HYDRAULIC TABLE TRAVERSE | HAND AND AUTOMATIC WHEEL FEED | MICROSPHERE WHEEL SPINDLE BEARINGS |
|---|---|---|---|---|---|
| 4" Type H | ✓ | ✓* | ✓ | ✓ | ✓ |
| 6" Type CH<br>10" Type LCH | ✓ | ✓* | ✓ | ✓ | ✓ |
| 10"—14" Type CH | ✓ | ✓* | ✓ | ✓ | ✓ |
| 14"—16" Type F | | ✓* | ✓ | ✓ | ✓ |

* Hydraulic straight infeed available as optional equipment.

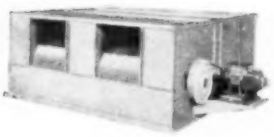
6" Type CH



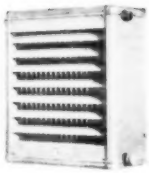
14"—16" Type F

LANDIS TOOL COMPANY / WAYNESBORO, PENNA.

# WESTINGHOUSE ANNOUNCES A NEW STURTEVANT FAN... THE MOST EFFICIENT CENTRIFUGAL FAN EVER BUILT



AIR HANDLING UNITS



UNIT HEATERS

CENTRIFUGAL FANS

REFRIGERATION CONDENSERS

Positive new savings for every cubic foot of air moved! *No centrifugal fan has ever been built that will move air with as little power as the new Sturtevant Silentvane.* Efficiencies in excess of 80% are obtained over 37 per cent of the usual application range. *Peak efficiency now reaches 86%.* Check these five outstanding features:

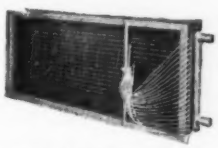
1. **QUIET OPERATION**—because of the streamlined inlet and careful attention to smooth eddy-free air flow.
2. **INHERENT HIGH EFFICIENCY**—because of basic Silentvane design.
3. **TRUE SELF-LIMITING AND NON-OVERLOADING HORSEPOWER CHARACTERISTIC**—at any given speed.
4. **SPEED FLEXIBILITY**—for direct connection or belt drive.
5. **FREEDOM FROM DUST LOADING**—because of flat blade surfaces and fewer blades.

Here is the answer to your heating, air conditioning or industrial ventilating requirements. Call your Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

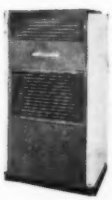
# Westinghouse
## Sturtevant Division

REFRIGERATION COMPRESSORS

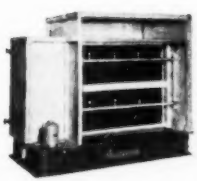
AXIAL FLOW FANS



HEATING AND COOLING COILS



UNIT
AIR CONDITIONERS

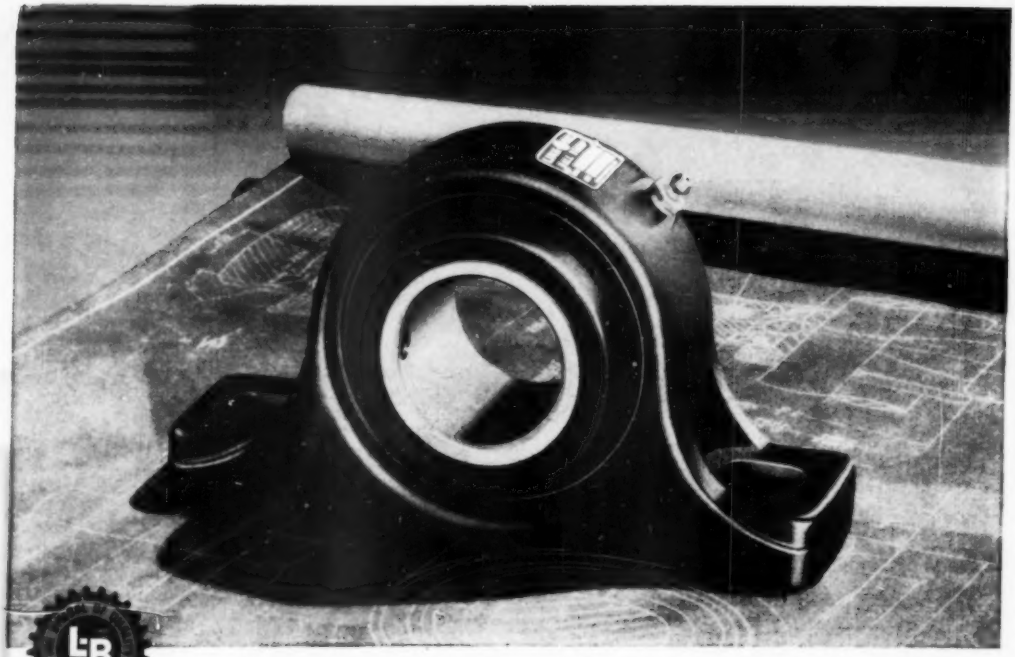


SURFACE DEHUMIDIFIERS

PRECIPITRON*
(ELECTRONIC AIR CLEANER)

**Everything that puts air to work for Every application**

*Reg. U. S. Pat. Off.



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## SPECIFY *LINK-BELT* BALL AND ROLLER BEARINGS

You can **Depend** upon LINK-BELT for:

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2 PERFORMANCE
3 ECONOMY
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6 SERVICE

There's no question about the high quality of Link-Belt Ball and Roller Bearings.

Considering the precision manufacturing processes, the skilled use of the most modern equipment under closest control, and the years of scientific research to furnish industry with longer-lasting, more efficient bearings, it is little wonder that "Link-Belt" quality is unquestioned.

Eliminate all guesswork — specify "Link-Belt" on your next bearing order. Choose with the utmost confidence from the COMPLETE Link-Belt line . . . various mountings and sizes for practically all types of industrial applications.

Good supplies of these popular bearings await your commands at distributor's and Link-Belt stockrooms throughout the nation.

11,827

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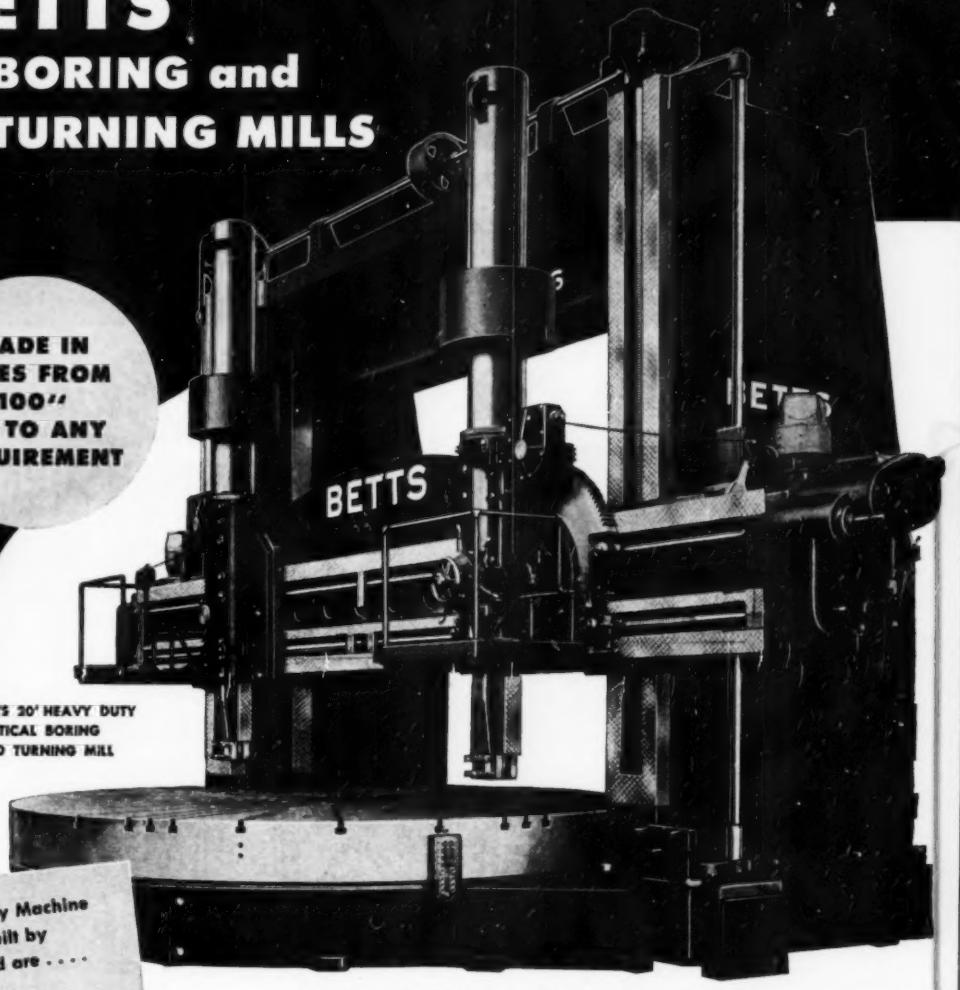
**LINK-BELT COMPANY**

Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8.

**LINK-BELT**
**BALL AND ROLLER BEARINGS**

# BETTS
## BORING and TURNING MILLS

**MADE IN SIZES FROM 100" UP TO ANY REQUIREMENT**




BETTS 20' HEAVY DUTY VERTICAL BORING AND TURNING MILL

**Among Heavy Machine Tools built by Consolidated are . . . .**

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
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AND OTHER SPECIAL MACHINES

Betts Heavy Duty Boring and Turning Mills are general purpose tools of simple, rugged design particulary adapted to heavy continuous operations requiring a high degree of accuracy combined with power. Among the outstanding features that have made Betts Mills leaders in their field, is their type of table mounting that insures positive concentricity. They are built in a size range from 100" swing up to any size to meet your requirements.

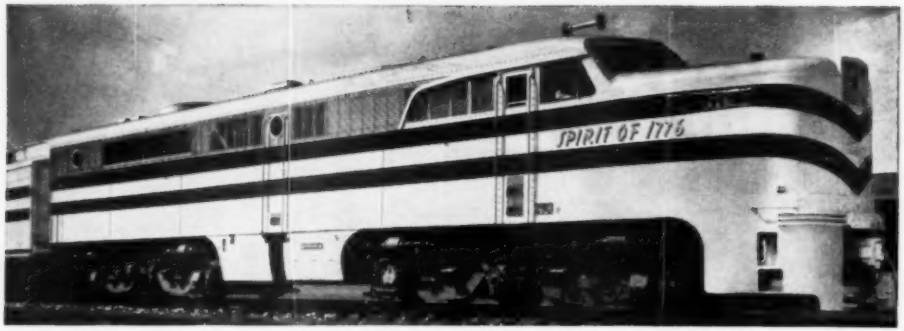
*Full information covering any size Betts Boring and Turning Mill in which you are interested will be furnished upon request.*

**BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848**

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

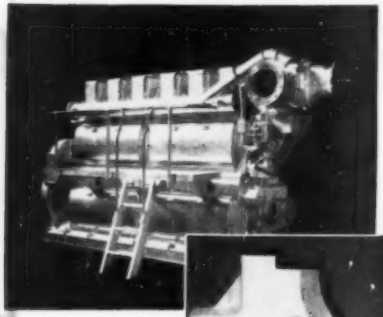
# CONSOLIDATED
## MACHINE TOOL CORPORATION
ROCHESTER 10, NEW YORK

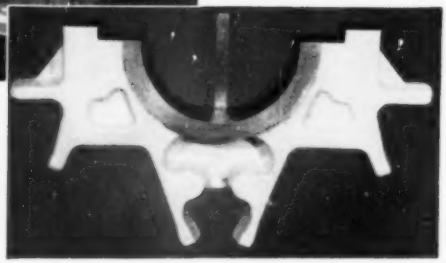



# 20 TIMES the PRODUCTION *by Broaching*

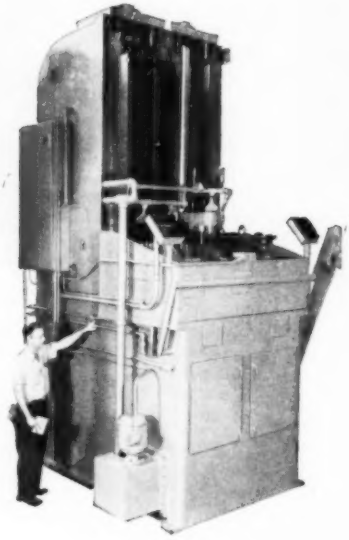
## DIESEL BEARING SUPPORTS

American provided the manufacturer of diesel engines with an SBD 72"-40 duplex surface broaching machine to finish broach the stepped joint faces and rough broach the 8" diameter half round on main bearing saddle forgings.





*One half inch of stock is removed in broaching the stepped joint face and half round.*



Approximately sixty cubic inches of surface on this 150 pound diesel engine main bearing saddle forging is removed in broaching by the adaptation of an automatic indexing table and broach arbor arrangement.

The left hand station broaches the step joint faces in six passes and the right hand station rough broaches the half round surface in six passes. The left hand table automatically indexes at each pass and the arbor on the right hand ram also automatically indexes at each pass to develop the radius form with four sectional broach assemblies. One part is completed at end of the six continuous passes.

American engineers will recommend the machine and tooling whenever broaching is the answer to your machining problem. Send part print and production requirement or write for the name of our dealer in your territory. They will be pleased to call.

**American BROACH & MACHINE CO.**

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

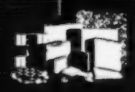
**See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery**

GRINDING WHEELS

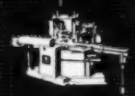
GRINDING MACHINES

REFRACTORIES

NORBIDE



NON-SLIP FLOORS



LABELING MACHINES

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Every Norton product—from Worcester as well as from the Behr-Manning division at Troy—will bear this symbol of Norton quality.

The main Worcester plant of Norton Company—world's largest producer of abrasive products

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# Improved Spindle Design

The diameter of this spindle has been increased to 3¼", adding 37% to its rigidity.

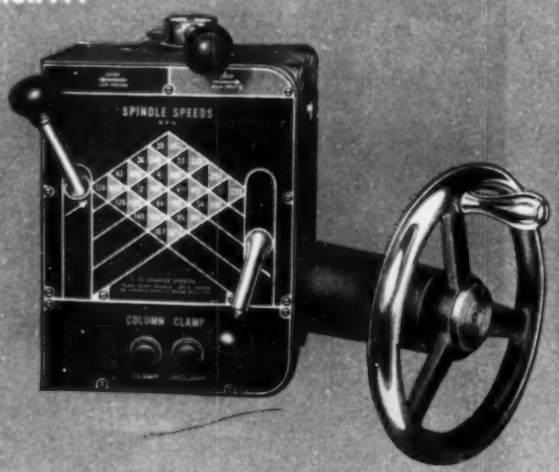
For long life the 100% anti-friction design of the Hole Wizard Spindle with adjustment for wear insures frictionless operation and maintenance of original accuracy. When severe drilling, tapping, or boring operations are performed thru the large driving gear of the Double Lo-Hung Drive, all thrusts are taken by the large bush, as shown by the accompanying illustration, which completely relieves the spindle of such stresses and definitely prolongs its life and accuracy.

The spindle and mating sleeve are made of nitralloy, nitrided to 70 Rockwell C—impervious to wear. Because of this extreme hardness, the running clearance between the ground spindle and honed sleeve is reduced to .00025". This spindle stability is especially valuable for exacting boring jobs.

# Speed Changes made Quickly

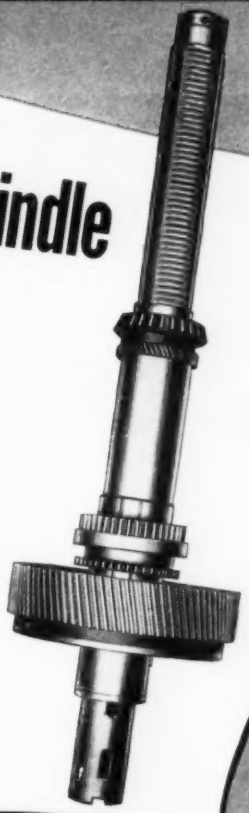
**and without confusion . . .**

**The Hole Wizard speed-changing mechanism is DIRECT READING. The operator no longer has to refer to instruction charts in order to make speed changes. The speeds are right in front of him in plain view and all he has to do is to move the levers to the speed he wants. The ease and rapidity of speed changing on the Hole Wizard encourage the operator to use correct speeds for his work.**



**THE AMERICAN TOOL WORKS CO.**

# The Double Lo-Hung Spindle Drive has definite virtues



This combination insures long gear life, a continuance of smooth power flow and freedom from gear noise.

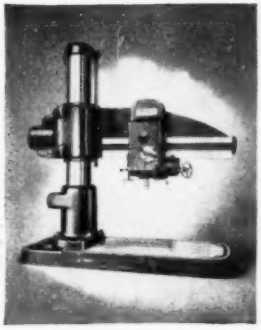
It provides two (2) spindle driving gears. Of the 32 spindle speeds provided the 16 high speeds are secured thru the smaller of the two gears while the 16 slow speeds are secured thru the larger gear. By providing a smaller diameter driving gear for the high speeds, gear velocities can be held within reason, and by providing a large driving gear for the slow speeds, which are used for the severest operations, gear tooth pressures are kept correspondingly low.

It minimizes tooth pressures from severe operations.

It reduces the velocity of the driving gears on high spindle speeds.

This ideal drive which divides the driving service between two gears is exclusively "American".

## Design Features that pay dividends to Hole Wizard Users . . .



1. Automatic oiling and cleansing of column sleeve to prevent "column scoring."
2. Tapping attachment speed-up that backs out taps 40% faster than tapping speed.
3. All gears and shafts hardened—all bearings anti-friction—elevating screw and back shaft hardened. All units anti-friction mounted and automatically oiled.
4. Safety nut guaranteed to prevent arm from dropping—a valuable safety feature.
5. Spindle speeds direct reading, instantly selected and secured—encourages operators to use correct speeds.
6. Auxiliary spindle counterbalance for handling heavy tools—provides same tension on spindle throughout entire travel.

**Cincinnati, Ohio U.S.A.** LATHES AND RADIAL DRILLS

# Announcing Big MORSE Cash Contest!

MAGNIFIED 6 TIMES ACTUAL SIZE

# $1,000.00 PRIZE

## FOR THE BEST NAME for this NEW MORSE DRILL

### AND 5 OTHER VALUABLE PRIZES

| | |
|---|---|
| First Prize | $1,000.00 cash |
| Second Prize | $200.00 cash |
| Third Prize | $50.00 cash |
| Fourth Prize | Set of 4 dozen drills, any size you want. |
| Fifth Prize | Set of 2 dozen drills, any size you want. |
| Sixth Prize | Set of 1 dozen drills, any size you want. |

NOW IN YOUR INDUSTRIAL SUPPLY DISTRIBUTOR'S STOCK

**TERMS OF THE CONTEST**

1. This contest does not cost you a cent, nothing but a little time and thought. No forms to fill out, either. Just typewrite your suggestions on a sheet of white paper the size of this page (smaller sizes might get lost) and write your name and address.
2. There's no limit to the number of names you can send in.
3. Any person residing in the continental U.S. may submit entries—except employees and the families of employees of Morse Twist Drill & Machine Co., and its advertising agency.
4. In case of duplication of winning name, duplicate prizes will be awarded.
5. No entries can be returned, and all entries become the sole property of Morse Twist Drill & Machine Co.
6. Entries must be postmarked not later than midnight, March 15, 1949.
7. The decision of the judges will be final.
8. *Address all entries to:* NEW NAME CONTEST, Morse Twist Drill & Machine Co., New Bedford, Mass.

**WINNERS WILL BE ANNOUNCED IN THE MAY ISSUE OF THIS AND OTHER INDUSTRIAL MAGAZINES . . . WATCH FOR THEM!**

**FEATURES OF NEW MORSE DRILL:** This new gold-colored Morse Drill delivers 50% more production, on multi-spindle automatic machines. This longer life comes from greater toughness and flexibility . . . and guarantees substantial savings because of far fewer drill-changeovers.

Here is a *completely new* drill . . . ground from the solid, with heavier web, increased twist, and wider flutes that clear chips through hole and jig bushing in a fast easy flow. *But here's the final payoff:* Morse has added something new to drill manufacture . . . *an extra, exclusive process* that gives this drill more strength *—more plain fighting guts to withstand higher speeds—* than any other drill. This has been proved by thorough field tests. 58 sizes, from No. 80 to ½", are now available through Morse-Franchised Distributors.

**SOLD EXCLUSIVELY THROUGH MORSE-FRANCHISED DISTRIBUTORS**

*Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manufacture*

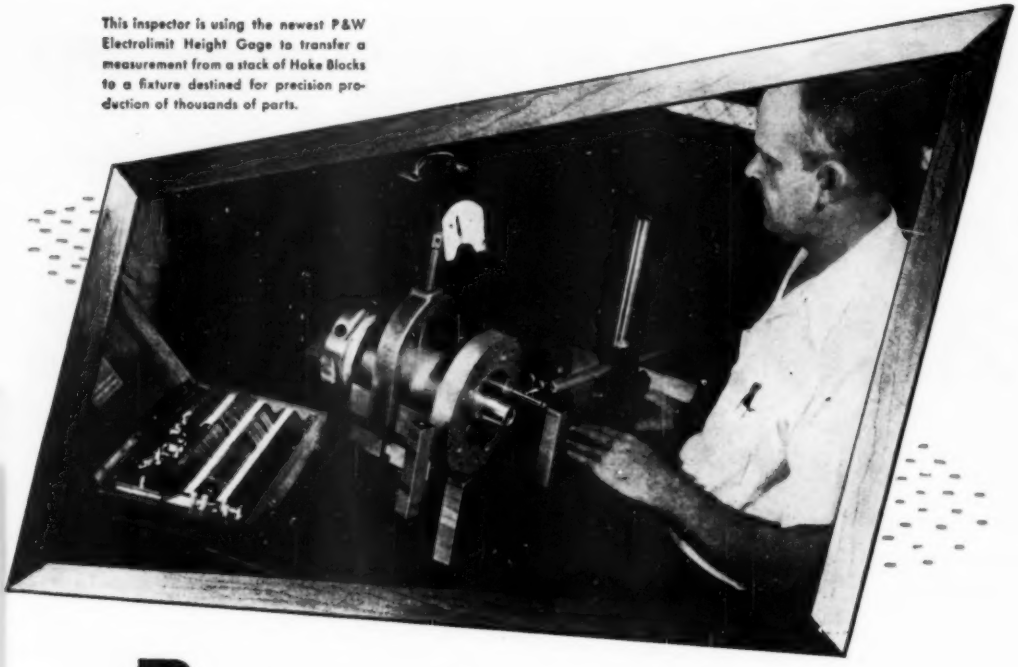
# MORSE TWIST DRILL & MACHINE COMPANY

NEW BEDFORD, MASSACHUSETTS

A DIVISION OF VAN NORMAN COMPANY

**BRANCH WAREHOUSES: NEW YORK, DETROIT, CHICAGO, SAN FRANCISCO**

This inspector is using the newest P&W Electrolimit Height Gage to transfer a measurement from a stack of Hoke Blocks to a fixture destined for precision production of thousands of parts.



# Picture of confidence

**The Confidence That Stems From Millionths Precision—**
**Pratt & Whitney Gage Block Precision**

You could take pictures like this in hundreds upon hundreds of shops and toolrooms the country over—pictures of P&W Hoke or USA Gage Blocks transferring their supreme accuracy to tools or parts that extend precision in turn to mass production on which prosperity depends.

P&W Precision Gage Blocks inspire the confidence that means quick, sure accuracy in gaging, checking, inspecting. They are *accuracy's greatest common denominator* — blocks that build the very foundation of American precision. They are available in sets and sizes to meet your every need.

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HOKE USA
PRECISION GAGE BLOCKS
Accuracy's Greatest Common Denominator

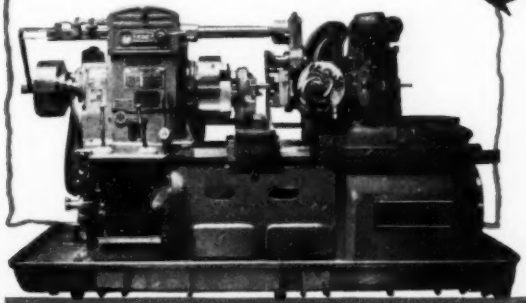
# A 5 MINUTE JOB

## WHEN IT'S DONE ON A P&J 5DE WITH P&J TOOLING

The finest Automatic Turret Lathe built — one like the Potter & Johnston 5DE, for example — is no better for a given job than the tooling that's applied to that job.

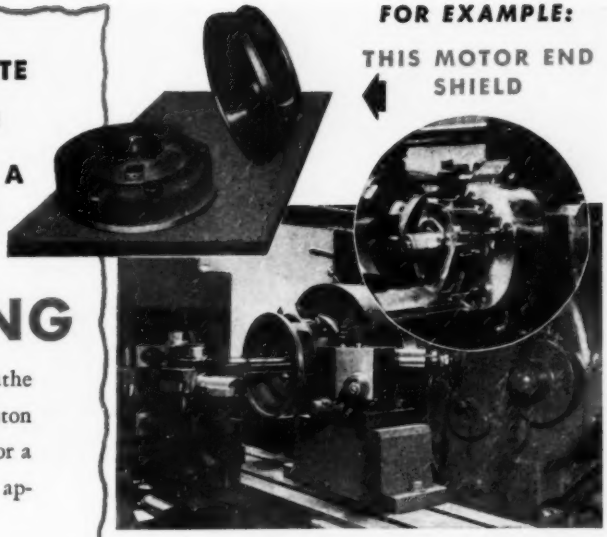
Potter & Johnston Tooling Engineers have the experience and the ingenuity to work out the one best combination and sequence of machining operations for high speed, high precision, low cost parts production.

It will pay you to send parts or prints to P&J for recommendations and estimates. Seeing what we can do puts you under no obligation and may point the way to production gains and savings of substantial importance.



**FOR EXAMPLE:**

**THIS MOTOR END SHIELD**



**P&J TOOLED FOR THESE SUCCESSIVE OPERATIONS:**

Closed side to spindle . . . gripped by 3 jaw chuck.

1st T.F.: Rough bore hole; rough turn O.D.; rough bore two dias.; machine dovetail groove in O.D.

2nd T.F.: Straddle face small hub; rough face bottom of counterbore; rough face end.

3rd T.F.: Finish bore hole; finish turn O.D.; finish bore counterbore; chamfer.

4th T.F.: Finish straddle face small hub; finish face bottom of counterbore; finish face end.

5th T.F.: Drill 6 small holes.

*Inset pictures the P&J multiple drilling setup on 5th T.F., an exclusive P&J feature that saves a lot of time and trouble.*

***All done in 5 minutes*** **on this P&J 5DE Automatic Turret Lathe:** a powerful, rigid production unit with 20 changes of speed, arranged in five sets of four automatic changes; 24 feeds arranged in geometric progression; automatic binding of turret following index; direct cross slide action and constant high speed traverse motion to cross slide and turret slide. Write for Bulletin giving complete specifications.

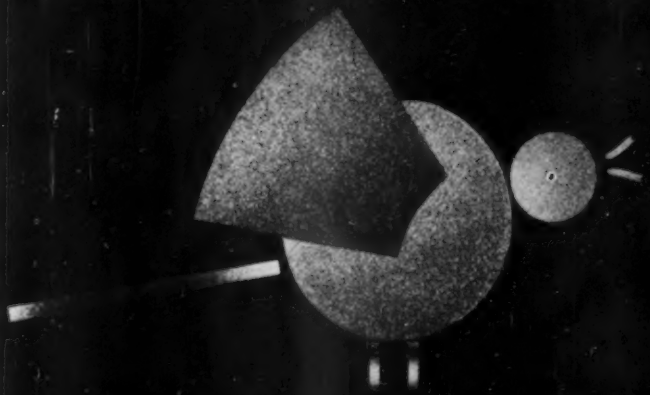
**5DE AUTOMATIC TURRET LATHE**

**Potter & Johnston Company**

Pawtucket, R. I.

subsidiary of Pratt & Whitney Division Niles-Bement-Pond Company

P&J



# Get a complete picture of your grinding costs

***Why*** not look at your grinding operations in the light of lowering your grinding costs?

Could you get longer wheel life, without cutting down on stock removal? Is it possible to keep dressing expenses and wheel wear down, and avoid wheel loading? Your entire grinding procedure can be brought into sharp focus by consulting with Peninsular engineers on your particular grinding problems.

***Since*** 1889, the Peninsular program of study and research has helped manufacturers get the utmost out of their grinding operations. *Why not call on Peninsular experts to help you?*

They will make an on-the-spot study of your machines, your grinding methods, and the materials which you grind. Then, from these basic facts, they will develop recommendations as to the most effective grinding wheels for your individual needs. The wheel formulas they recommend will be *custom-tailored to the specific job.*

***Snap thought:*** Peninsular makes many types of grinding wheels, and each one measures up to the Peninsular standard—the finest it is possible to produce, the most efficient for the job at hand.

**The Peninsular Grinding Wheel Co.,** 729 Meldrum Ave., Detroit 7, Michigan. *Sales Offices:* Chicago, Philadelphia, Buffalo, Cleveland, Pittsburgh, Houston, St. Louis, Cincinnati.

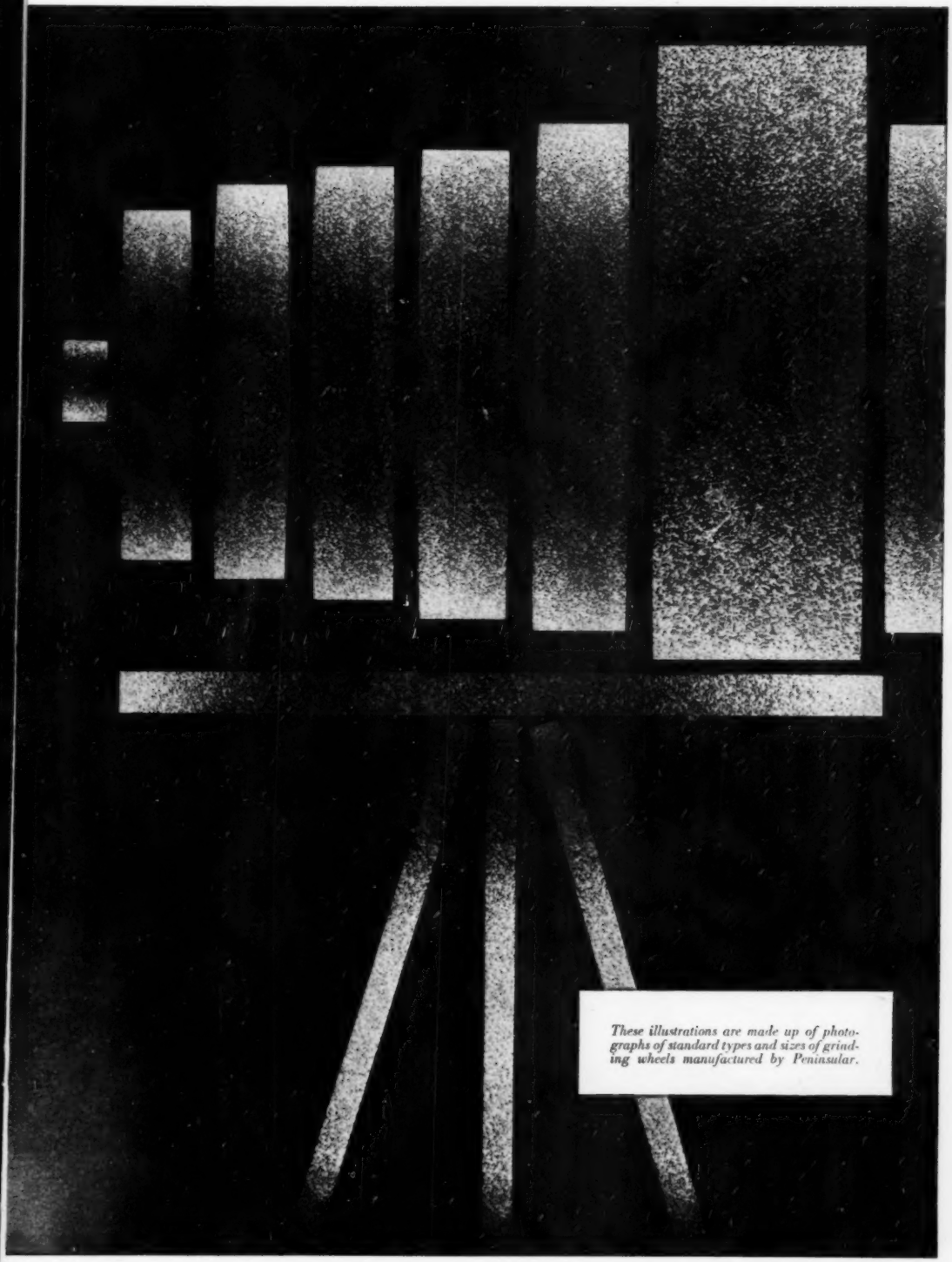
# PENINSULAR

*INDIVIDUALLY* PENINSULAR *ENGINEERED*

## GRINDING WHEELS

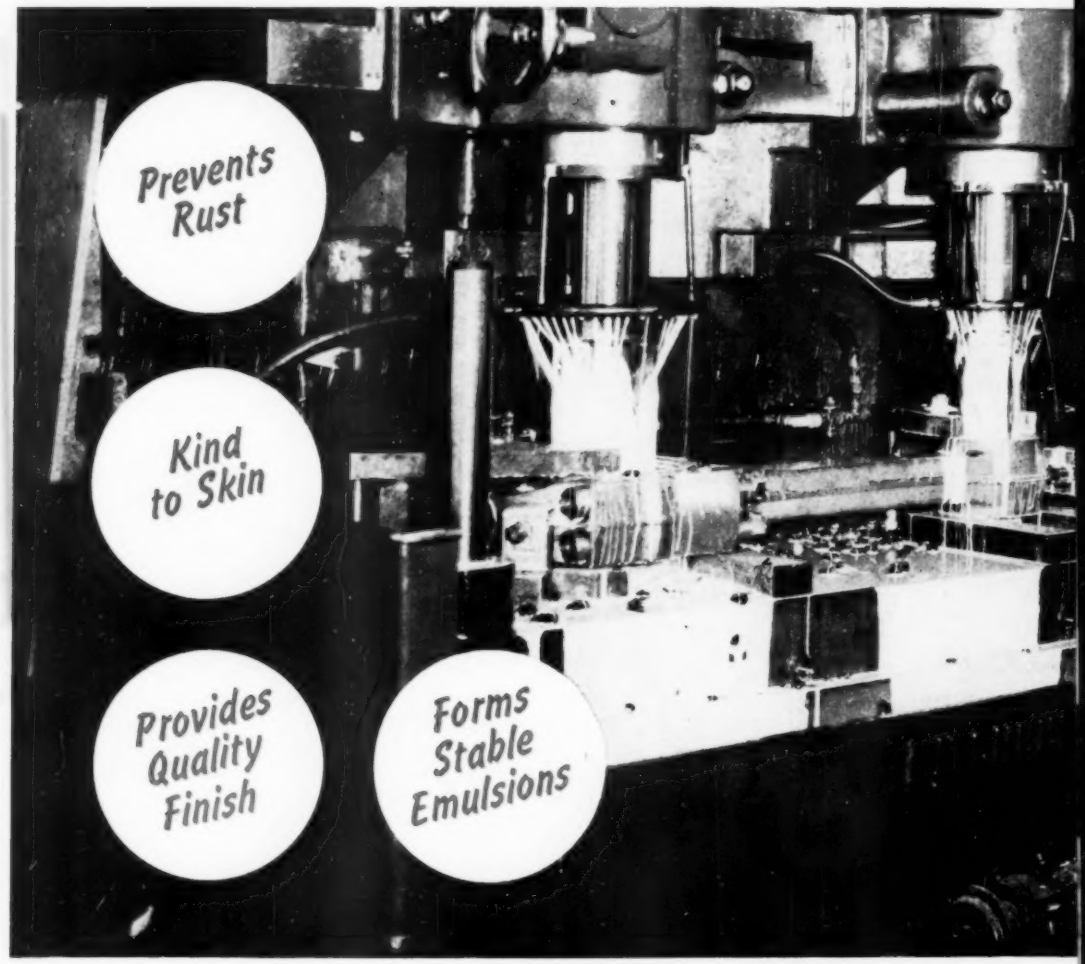
*SINCE 1889*

SPECIALISTS IN RESINOID BONDED WHEELS



*These illustrations are made up of photographs of standard types and sizes of grinding wheels manufactured by Peninsular.*

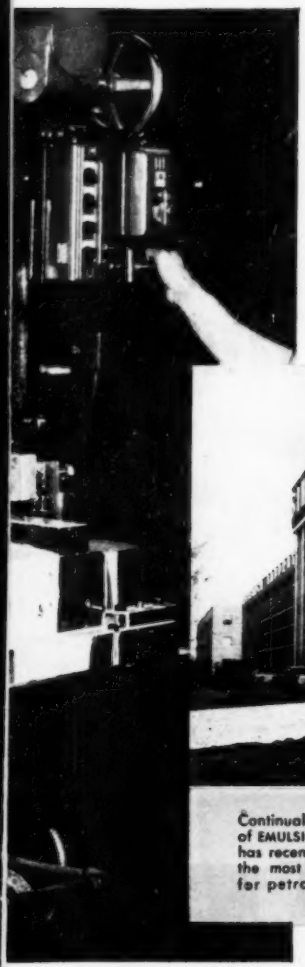
# Sinclair EMULSICOOL Fine Product




SINCLAIR

YOUR NEAREST SINCLAIR AGENT WILL GLADLY ARRANGE

# Gives Finish at Less Cost



One of the ever-present concerns in metal working production shops is cost of production. In many operations the use of Sinclair EMULSICOOL as the cutting fluid helps solve this problem. Without sacrificing tool life EMULSICOOL provides high quality finish at less cost.

EMULSICOOL mixes easily with any water—hard or soft—to form stable emulsions. EMULSICOOL has rust protective qualities, too. It does not affect the operator's skin and eliminates troublesome gumming of the machines.

For fine finish, clean operation, easy handling and rust protection, EMULSICOOL is the ideal,economy soluble oil.

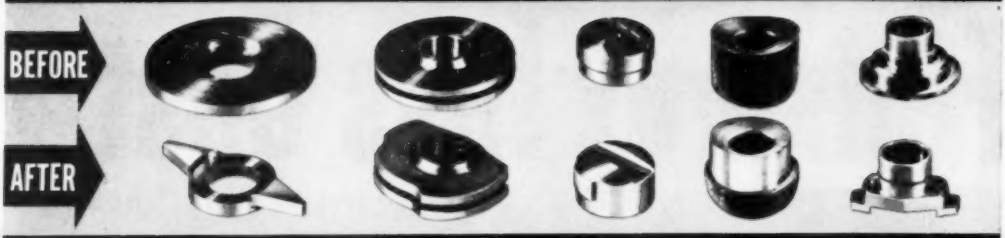
Continual research explains the high quality of EMULSICOOL and other Sinclair Oils. Sinclair has recently completed at Harvey, Ill., one of the most modern and complete laboratories for petroleum research and development.

E. W. Isom, Sinclair Vice-President in Charge of Research says: "With the new facilities now made available to us at Harvey, Ill., we expect to find many ways to help industry cut costs through better petroleum products."

## INDUSTRIAL OILS

**FOR LUBRICATION COUNSEL, OR YOU MAY WRITE TO SINCLAIR REFINING COMPANY, 630 FIFTH AVE., NEW YORK 20, N. Y.**

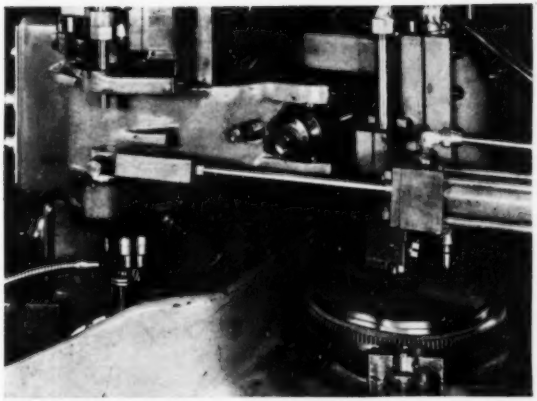
# If Your Production Requires Milling Intricate Parts Like These



## You Need the New Sundstrand *Cam-Controlled* Contour Milling Machine

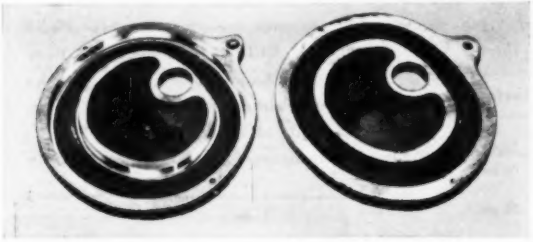
SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

RIGIDMILS • FLUID-SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT



## Mills Both External and Internal Cams

Yes, you'll find this new Sundstrand contour milling machine adaptable to an endless variety of milling operations on irregular shaped parts. It's a single vertical spindle cam-controlled, hydraulically operated milling machine. Both internal and external contours can be milled quickly and accurately on parts of 5" diameter or less. Machine adjustments can be quickly and easily made for over 24 different cycle combinations. The ¾ HP adjustable speed spindle motor has ample power and speed range for the size of work for which the machine is intended. Since one operator can easily attend several machines, cams of various shapes can be produced at a savings on a production basis. Illustrated below is a good example of internal contour milling. Typical examples of other external contour milling operations are illustrated on the opposite page. Sewing machine, gun, governor, business machine and many other small parts can be handled on this versatile machine.



## Mills Master Cams

You will save many hours of engineering intricate cam profiles with this machine. Through the substitution of a cam-cutting spindle to replace the cam roller spindle, the machine operating procedure can be reversed to produce cams by merely following the sample part which is clamped in the fixture on the machine table.

## Simple to Operate

In spite of the complex work performed by this machine, it is amazingly simple to operate. It is completely automatic, yet easy to set-up for the different jobs. This simplicity of operation makes it possible for one man to handle several machines without sacrifice of accuracy or production.

## Write for Complete Data

This new 6-page folder contains complete information and specifications of this production contour milling machine. More detailed description covering the 24 automatic cycles and how easily they can be set-up to handle the milling of a wide variety of contours is included. If your work includes milling intricate contours on a production basis, get this bulletin on the new Sundstrand cam-controlled milling machine. It's FREE. Ask for Bulletin No. 180.

SUNDSTRAND MACHINE TOOL CO.

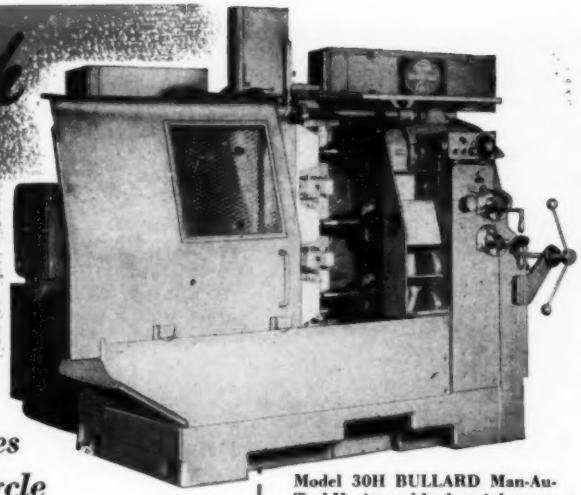
**SUNDSTRAND**

**MACHINE TOOL COMPANY**

**2533 Eleventh St. • Rockford, Ill., U.S.A.**

**DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES**

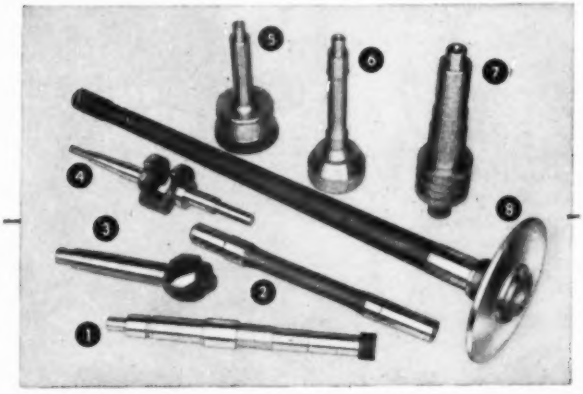
# It's 3 for 1 with BULLARD MODEL 30H HORIZONTAL LATHE



## *Model 30H Man-Au-Trol Horizontal Lathe Produces 3 Identical Pieces Per Cycle*

**Reports are now coming in from owners of BULLARD Man-Au-Trol Horizontal Lathes proving that this machine's unique "3 for 1" method really pays off in lower production costs. See the accompanying chart for some actual figures.**

**Model 30H BULLARD Man-Au-Trol Horizontal Lathe triples production on between-center shaft turning work by machining 3 finished pieces per cycle with its 3 identically tooled spindles. Simplified tooling for rough and finished cuts also reduces tooling costs. Multiple-tool blocks are provided when needed for grooving, recessing, chamfering, angle-turning and other such operations.**




***These 8 Production Reports May Suggest Big Savings For YOU***

| Number | Part | Material | 3 Pcs. Floor to Floor Time | Time per Piece |
|---|---|---|---|---|
| 1 | Third Motion Shaft | Steel Forging | 2.21 min. | 44 sec. |
| 2 | Inner Axle Shaft | SAE 4140 | 1.c2 min. | 32 sec. |
| 3 | Sector Shaft | SAE 5132 | .8 min. | 15 sec. |
| 4 | Crankshaft | Steel Casting | 2.25 min. | 45 sec. |
| 5 | Overdrive Main Shaft | SAE 4620 | 1.96 min. | 39 sec. |
| 6 | Outer Race Bell | SAE 4620 | 2.0 min. | 40 sec. |
| 7 | Counter Shaft | SAE 4320 | 1st chg. 1.78 min. 2nd chg. 1.63 min. | 36 sec.—1st chuck 32.6 sec.—2nd chuck |
| 8 | Rear Axle Shaft | SAE 8630H Forge | 2.30 min. | 46 sec. |

### WANT ALL THE FACTS?

Here's a Lathe with unique "3 for 1" productivity, right-handed operating convenience, Man-Au-Trol versatility, (manual or automatic operation) and startling performance.

In the interest of lower manufacturing costs, make a study of the Model 30H BULLARD Man-Au-Trol Horizontal Lathe. Write today for booklet and time studies on your work. THE BULLARD COMPANY, Bridgeport 2, Connecticut.

### 16 MM SOUND MOTION PICTURE

**available for Group Showing by writing for scheduling. When writing advise your preferred date.**

## USE BULLARD MACHINES FOR PRODUCTION ECONOMY

*What's in*
VERMONT
*this month?*

## EMERGENCY CHANGEOVER WITH BRYANT GRINDERS

THE metalworking industry is plagued with the thought of an emergency changeover, a changeover from one product to another — a changeover that requires new machine tools and new tooling.

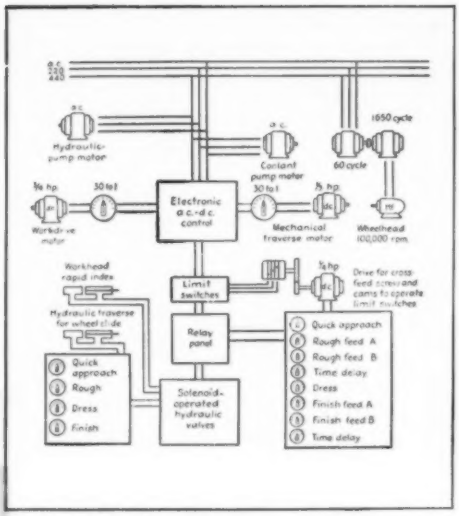
Present day requirements demand fully automatic machines which as a rule do not lend themselves to rapid changes.

If you have a hole-finish problem which could use a fully automatic internal grinder you can purchase it today with full confidence that it will fit into the new production line in the shortest possible time. The Bryant Internal Grinders lend themselves to quick changeover. The fully automatic cycle can be changed in a matter of minutes and Bryant engineers are available to help in special fixture design.

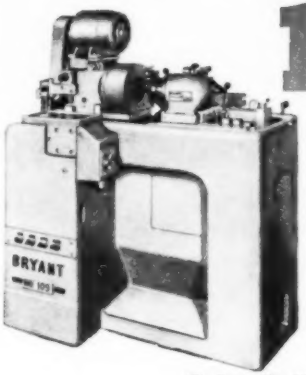
This is an example of how the machine tool manufacturers are ready at any time to see that the American metalworking industry produces the most and the soonest.

It won't cost to inquire.

**Bryant Chucking Grinder Co. • Springfield, Vermont, U.S.A.**




# BRYANT 109




*The Bryant No. 109 Internal Grinder is designed for high precision production of holes from ¼ to 2½ inches in diameter. Other Bryant equipment will grind holes through the complete range up to 60 inches diameter swing. Write to the factory for full information.*

# AUTOMATIC INTERNAL GRINDER

**SPECIFICATIONS**

| | |
|---|---|
| Total swing | 9 inches |
| Will grind bore diameters | ¼ to 2 ½ inches |
| Maximum traverse | 6 inches |
| Maximum hole depth | 3 inches |
| Will grind included angle | 90° |
| R.P.M. of work spindle | 200 to 2,400 R.P.M. |
| Net weight | 3,000 lbs. |
| Floor space — 62 inches x 52 inches (with coolant tank) | |

**SLIDES**
Preloaded ball slides for both cross and longitudinal motion.

**WORKHEAD**
Ball bearing spindle, variable speed electric drive, 200 to 2,400 R.P.M.

**WHEELHEAD**
Precision ball bearing wheelhead with built-in high frequency electric motor — speeds up to 100,000 R.P.M.

**TRAVERSE**
Hydraulic — 4 stations in automatic cycle, each variable — see drawing.

**CROSS FEED**
Eight variable stations in automatic cycle — see drawing.

**POWER**
Machine operates from standard AC current.

## You can *"See the Difference"* with a BRYANT GAGE

**BRYANT INTERNAL & EXTERNAL THREAD GAGES.** Bryant thread gages are made in three standard models for the fast, accurate, visual inspection of threaded parts. These models cover the range from $\frac{3}{8}$" to 5" internal, and $\frac{3}{16}$" to 5" external. Write for Catalog No. G for details.

It is no longer necessary to "feel for fit" with plug and ring gages when inspecting threads. The Bryant Thread Gage shows, on a dial indicator, whether a thread will assemble properly with its component.

At a glance, anyone can compare threaded parts with a master and tell the whole story immediately — size, presence of burrs, out-of-roundness, accumulated inaccuracies of pitch, lead, diameter and thread form.

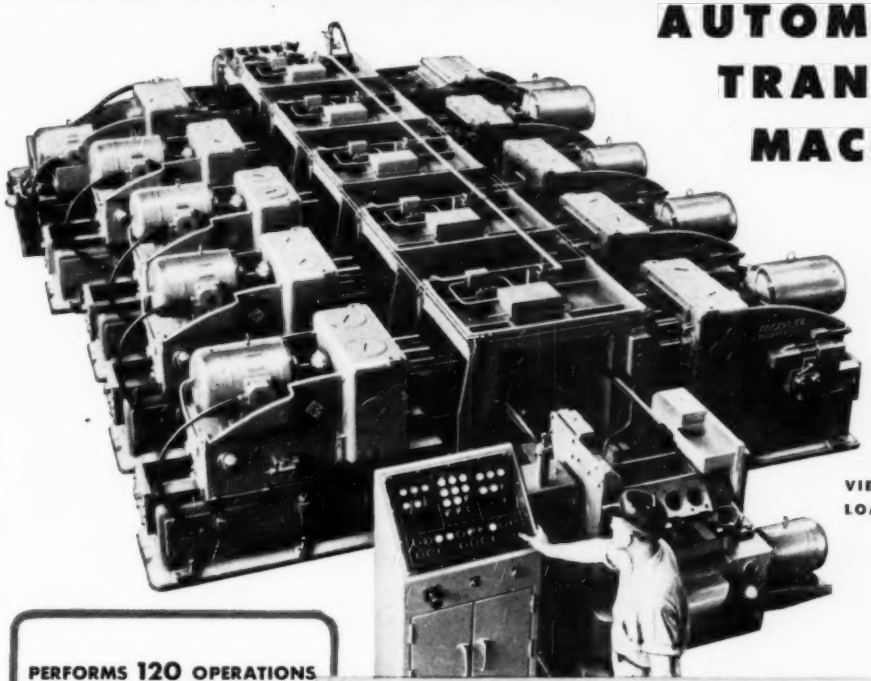
It's fast too. The design incorporates three thread segments, two stationary and one movable. The segments are operated by a thumb lever — the part is dropped between the segments — the lever is released, causing immediate contact of segments to threads — a one third turn of the part inspects it all over.

Send samples or drawings for a complete story on how Bryant can save inspection money for you.

**Bryant Chucking Grinder Co. • Springfield, Vermont, U.S.A.**

# GREENLEE

## AUTOMATIC TRANSFER MACHINE



VIEW FROM LOADING END

### PERFORMS 120 OPERATIONS

| | LEFT HAND UNITS | RIGHT HAND UNITS |
|---|---|---|
| STATION 1 — Load and Turn Over 180 Degrees | | |
| STATION 2 | Drill 12 Holes<br>Drill & Chamfer 2 Holes | Drill 14 Holes |
| STATION 3 | Drill 7 Holes | Drill 10 Holes |
| STATION 4 | Drill 3 Holes<br>C'Bore & Chamfer 1 Hole<br>Ream 2 Holes | Drill 2 Holes<br>11" Deep |
| STATION 5 | Drill 4 Holes<br>Ream 2 Holes<br>Chamfer 11 Holes | Drill 1 Hole<br>Ream 2 Holes<br>Chamfer 16 Holes |
| STATION 6 | Tap 14 Holes | Tap 17 Holes |
| STATION 7 — Unload | | |
| | 58 OPERATIONS | 62 OPERATIONS |

TOTAL — 120 OPERATIONS

## FOR PROCESSING CYLINDER BLOCKS

### PRODUCES 45 BLOCKS PER HOUR . . . AT 80% EFFICIENCY

This 7-station automatic transfer machine performs a total of 120 individual drilling, chamfering, counterboring, reaming, and tapping operations in a continuous cycle on cylinder blocks for a leading automobile manufacturer. The loading end of the machine is equipped with a turnover fixture that revolves the work 180 degrees, eliminating handling of the piece as it is received from previous machining operations.

Greenlee patented precision-ground individual lead screw spindles tap a total of 31 holes in both ends of the cylinder blocks. All tapping units are provided with a rapid approach and return stroke. Automatic tap lubrication insures clean, precision-cut threads with maximum tool life.

The electrically-controlled hydraulic units are easily accessible for set-ups and for making tool changes, and are designed so they can be independently operated. Ample room is provided between stations for work inspection. Automatic lubrication of each vital moving part assures long machine life and efficient operation.

The experience of Greenlee engineers and the skill of Greenlee manufacturing personnel were combined to produce this machine. The effectiveness of this Greenlee team can be used by you, too, toward the licking of *your* production machinery problems.

***Additional Information Available Upon Request***

PRODUCTION MACHINERY

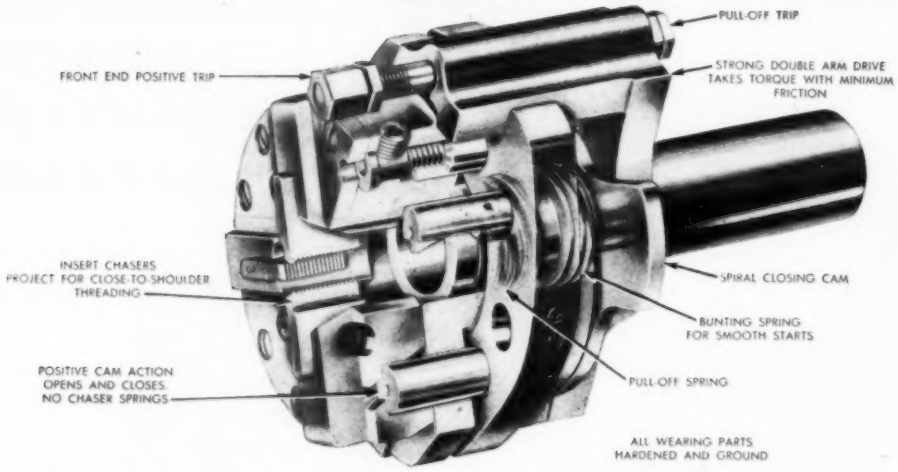
GREENLEE

**GREENLEE BROS. & CO., 1722 Mason Ave., Rockford, Ill.**

**DETROIT OFFICE: 504 CURTIS BUILDING, DETROIT 2, MICHIGAN**

MULTIPLE SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

# Style DM H & G Die Heads


PULL-OFF TRIP
FRONT END POSITIVE TRIP
STRONG DOUBLE ARM DRIVE TAKES TORQUE WITH MINIMUM FRICTION
INSERT CHASERS PROJECT FOR CLOSE-TO-SHOULDER THREADING
SPIRAL CLOSING CAM
BUNTING SPRING FOR SMOOTH STARTS
POSITIVE CAM ACTION OPENS AND CLOSES NO CHASER SPRINGS
PULL-OFF SPRING
ALL WEARING PARTS HARDENED AND GROUND

## For Faster Threading on B & S Automatics

### Production Results

*Steel Screw size 10-32 thread ⅜ inch long threaded with Style DM Die Head on a No. 00 Brown & Sharpe Automatic. 2,750 r.p.m. previously, 927 r.p.m. 1,000 pieces per hour; runs of 50,000 to 100,000 before grinding. Previously runs of only 3,000 were obtained.*

*Brass Pieces threaded with Style DM Head on a No. 00 Brown & Sharpe Automatic. Speed of 6,000 r.p.m. Thread 4-40 American National. Time, one and one-half seconds, or at the rate of 2,400 pieces per hour.*

*Sprinkler brass part 5 16-24 thread cut with Style DM Die Head. Part completed on No. 00 B & S Automatic 6,000 r.p.m. in less than five seconds 100,000 pieces before grinding.*

**THE TREND.** With machine-hour rates up sharply, the problem in screw-machine work is to speed up production and reduce down time. By choosing the proper die head, faster threading speeds and faster indexing can be utilized on Brown & Sharpe automatic screw machines.

**THE THREADING TOOL.** The Style DM H & G Insert Chaser Die Head is built with features that permit fast cutting speeds and fast indexing of the turret. These two advantages, plus others, enable greater *net* production per day at *lower* tool cost.

### Features of the Style DM Die Head

***Front-end trip.*** Three advantages of the front-end trip mechanism are: (1) premature tripping cannot occur from fast indexing of the turret, because the mechanism need not be set for quick pull-out action; (2) tripping always occurs each time at the predetermined length of thread; and tripping need not depend on a dwell.) (3) threading can be done *close to a shoulder or very short threads can be cut.*

***Pull-Off Trip.*** This is an always-ready safety device to open the die head if the turret should move back for indexing before the front-end trip functions.

***Double-Arm Drive.*** Two arms hold the die-head body in proper relationship to the shank. They take the torque as far as possible from center, reduce the friction and ensure smooth action. The bunting spring assures a smooth, positive start on the thread, especially when the lobes of the threading cams are set 5% fast, a desirable condition in order to avoid thread damage from a hesitating start.

***Insert Chasers.*** H & G *low-cost* insert chasers produce an unusual number of pieces before dulling, and any operator can change the complete set in a minute or so. No adjustments are needed. Proper location is inherent in the carriers. These features produce as much as an hour's extra production per day by the elimination of down time.

***Full Range of Sizes.*** Style DM Die Heads are made in sizes to cover the entire capacity ranges of these Brown & Sharpe automatics: No. 00, 0, 2, 4 and 6. And the die heads can also be used on other single-spindle machines where a non-rotating tool is suitable.

In addition, to Style DM other styles of H & G Insert Chaser Die Heads are available for all machines on which threads are cut. All four styles of H & G Die Heads use the same chasers within their capacities. This reduces and simplifies chaser inventory.

WRITE FOR STYLE DM BULLETIN AND DIGEST OF NEW UNIFIED SCREW THREAD SYSTEM

**THE EASTERN MACHINE SCREW CORPORATION**

**20-40 BARCLAY STREET, NEW HAVEN, CONNECTICUT**

H&G Insert Chaser DIE HEADS

# 100,000 Hours

## FROM ONE SET OF "SUPER-7" V-BELTS!

OVER 14 YEARS AGO, 66 complete *Texrope* drives were installed in New York's famous RCA building . . . on air-conditioning equipment for the NBC radio studios. Today, some of these *original* V-belts are still running, 20 hours a day, week in, week out!

*Texrope* drives were selected for two major reasons: First, they are completely noiseless and tend to dampen vibration of other parts. Second, multiple belts offer a greater safety factor, assuring service continuity. Now, after 14 years, a "bonus" of exceptionally long life has been added.

Records like this are one reason why more *Texrope* industrial V-belt drives have been installed since 1925 — when Allis-Chalmers originated the multiple V-belt drive — than any other kind.

*Texrope* drives offer you the widest selection of V-belt products in industry . . . V-belts, standard, adjustable and variable-speed sheaves, and speed changers.

**Send for Pre-engineered Drive Manual** — Lists stock components to cover 90% of V-belt drives. See your A-C dealer or District Office, or write direct for bulletin 20B6956. Also in Sweet's.

*Texrope Super-7* V-belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich; and are sold only by A-C dealers and offices. *Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks. A 2614

**ALLIS-CHALMERS, 999A SO. 70 ST.**
**MILWAUKEE, WIS.**

**ALLIS-CHALMERS**

***Sold . . .***
***Applied . . .***
***Serviced . . .***

**by Allis-Chalmers Authorized Dealers, Certified Service Shops and District Offices throughout the country.**

**MOTORS — ½ to 25,000 HP and up. Matching Allis-Chalmers Control.**

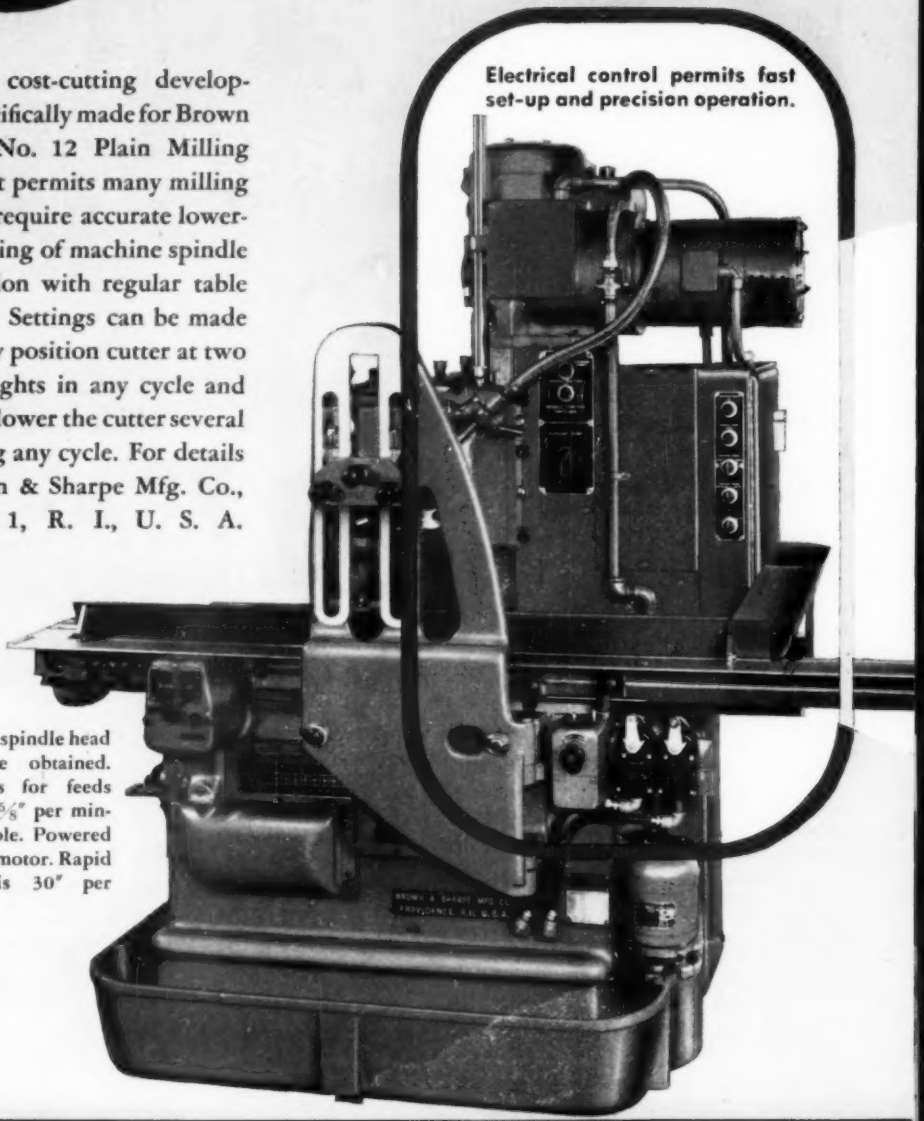
**TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.**

**PUMPS — Integral motor and coupled types. Sizes and ratings to 2300 GPM.**

# NOW Spindle Power Feed . .

## FOR NO. 12 PLAIN MILLING MACHINES

THIS NEW cost-cutting development is specifically made for Brown & Sharpe No. 12 Plain Milling Machines. It permits many milling cycles that require accurate lowering and raising of machine spindle in conjunction with regular table movements. Settings can be made to accurately position cutter at two different heights in any cycle and to raise and lower the cutter several times during any cycle. For details write Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

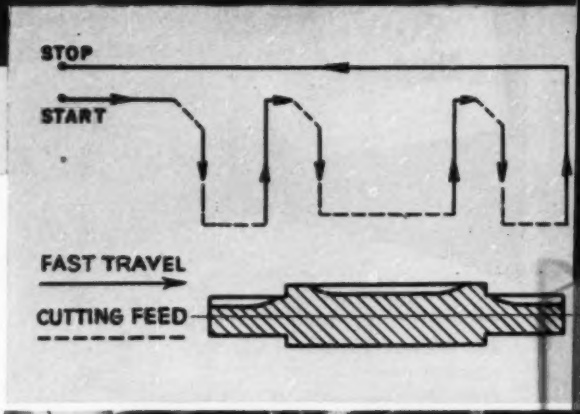


Electrical control permits fast set-up and precision operation.

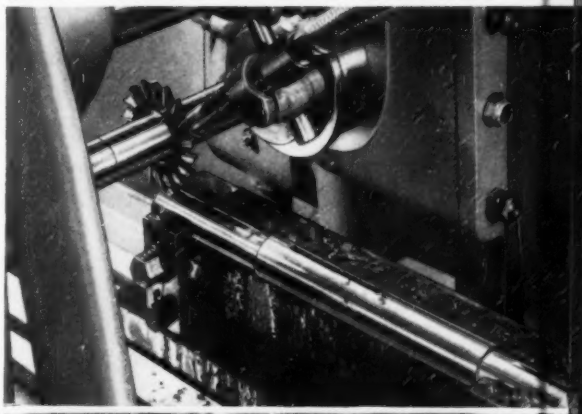
Wide range of spindle head feeds can be obtained. Pick-off gears for feeds from ½" to 7⅝" per minute are available. Powered by brake-type motor. Rapid travel rate is 30" per minute.

BROWN &

# *gives more work, with fewer set-ups*

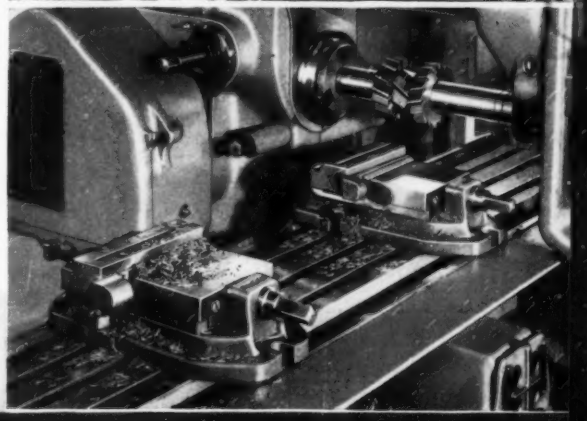



**THE DIAGRAM** at right shows one of many cycles made available by this new device. Horizontal arrows are for table direction, vertical arrows for spindle head direction, and the type of job is shown beneath the cycle. Cycles can be made with machine table starting in either direction. For information about a cycle that may simplify your milling, consult our Milling Engineering Service.



**MILLING THREE KEYWAYS,** as shown at the right, requires that the cutter operate at two different heights above the machine table. This operation is done automatically with the Spindle Power Feed Mechanism using cycle shown above.

**CLIMB MILLING AT BOTH ENDS** of table, *with the same cutters*, is made possible with this double fixture set-up. It is a continuous cycle with the spindle head power feed being used to raise the cutters to clear the work which has just been loaded in the second fixture. Climb milling makes possible increased feeds and longer cutter life. Often permits efficient milling of pieces difficult to hold.

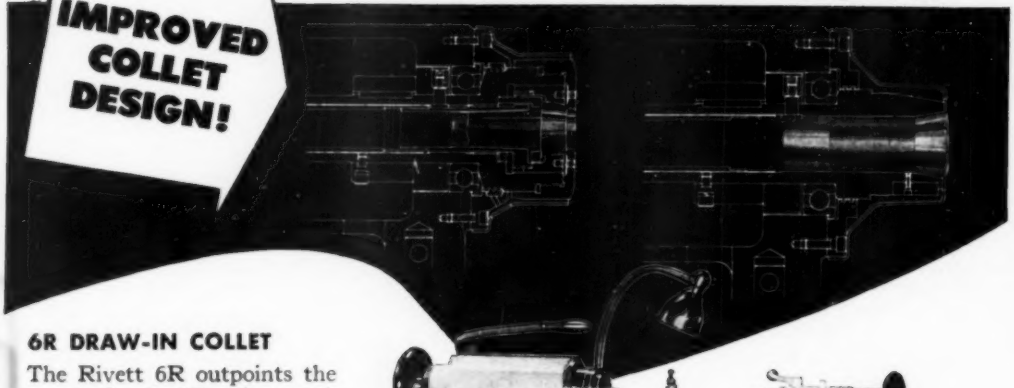


SHARPE B·S

ANOTHER *Plus* FEATURE OF THE *New* RIVETT PRECISION CABINET LATHE

STATIONARY OR DRAW IN COLLET

# IMPROVED COLLET DESIGN!



## 6R DRAW-IN COLLET

The Rivett 6R outpoints the conventional 5C (Cataract) draw-in collet in precision, capacity and gripping power.

Spacing of front and rear bearings is twice that of 5C collet — this spacing reduces the runout error on undersize or oversize stock. The greater the bearing spacing, the smaller the work runout beyond the collet face.

The 6R collet has $1\frac{1}{8}$" round hole capacity, $\frac{1}{8}$" greater than the 5C collet.

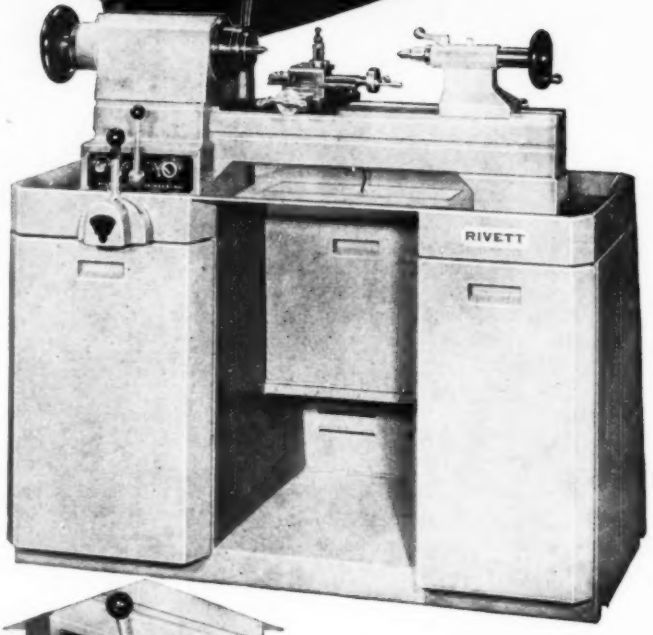
The length of jaws reduces force required to grip work. By test the 5C collet requires 15% more force by draw-bar to hold $\frac{1}{2}$" stock.

## 7R STATIONARY COLLET

The Rivett 7R has no "in" or "out" motion when closing on work. Lengths can be held; varying diameters have no effect on chucking.

*NO OTHER LATHE HAS COMPARABLE COLLET FEATURES*

*Write for Bulletin 918-SL*



## SPINDLE SPEED SELECTION

Correct spindle speed for any operation. Control lever affords any speed from 80 to 3700 r.p.m. Selected speed shows on dial.

RIVETT

**RIVETT LATHE & GRINDER, INC.**

BRIGHTON · BOSTON · MASSACHUSETTS · U. S. A.

## How to keep operators in the pink . . .

Specify the cutting fluid operators call the biggest working improvement in years—Cimcool®.

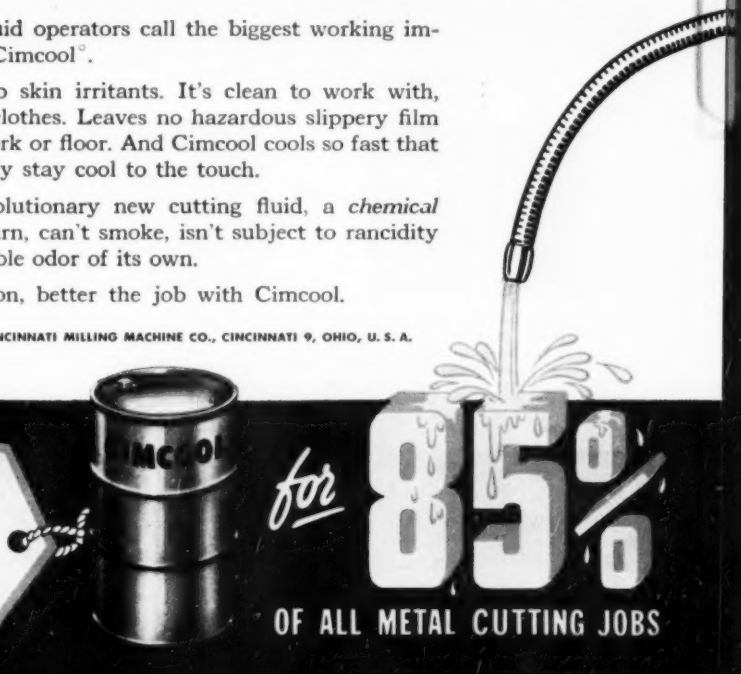
Cimcool contains no skin irritants. It's clean to work with, doesn't soil hands or clothes. Leaves no hazardous slippery film on hands, machine, work or floor. And Cimcool cools so fast that tools and chips actually stay cool to the touch.

Cimcool is the revolutionary new cutting fluid, a *chemical emulsion* that can't burn, can't smoke, isn't subject to rancidity and has no objectionable odor of its own.

For better production, better the job with Cimcool.

CIMCOOL DIVISION OF THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO, U. S. A.

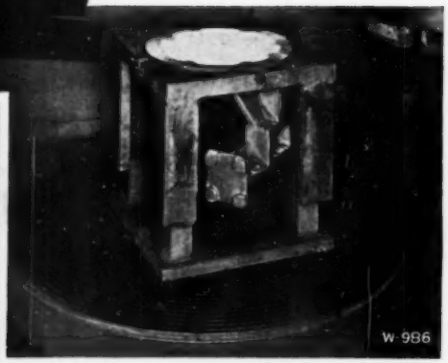
*Trade Mark Reg. U. S. Pat. Off.




*A Production-Proved Product of*
THE CINCINNATI MILLING MACHINE CO.

*for* 85% OF ALL METAL CUTTING JOBS

# DO IT THE *Easy* and *Profitable* WAY



**Here are three excellent examples of large irregular pieces being finished more easily and more profitably on Blanchard Surface Grinders, by the use of specially designed, extraordinarily simple, low cost holding fixtures. If the surface to be finished can be brought to the wheel, holding fixtures can be designed to hold the work for Blanchard Grinding.**

**Blanchard will gladly assist you in designing such holding fixtures, or design and furnish them at low cost.**

## *Put it on the* BLANCHARD

## HOW ELSE CAN YOU GET RESULTS LIKE THESE?

**W-894** Cast iron chain idler brackets were ground from rough casting to commercial finish. Grinding reduced the per-piece machining time to 3/10 that necessary when a miller was used. It was put on the Blanchard.

**W-957** Ten costly hours were saved finishing this milling machine universal saddle. Formerly an 11-hour hand-scraping operation, the time was slashed to 50 minutes. It was put on the Blanchard.

**W-871** These cast iron Bearing Gibs had ¼" removed from each of the four sides. Finished edges were accurately square with sides. Production rate was tripled. They were put on a Blanchard.

**Send for your free copies of "Work Done on the Blanchard" and "The Art of Blanchard Surface Grinding"**

BLANCHARD

*The* **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

# 67 chisel FOR SHOCK TOOLS

When tools and dies must take slam-bang shocks it's a job for 67 Chisel. This is a tool steel engineered for maximum shock-resistance. Toolmakers can rely on its capacity to withstand heavy, repeated impacts day after day, both on cold and hot work.

**Cold-Work Applications:** Cold-battering tools, chipping chisels, calking and beading tools, shear blades, punches, forming dies, cutting pliers. Carburized for extra wear-resistance, 67 Chisel is the first choice for master hobs used in cold-hobbing cavity molds. It is also recommended for tools having deep recesses, sharp corners, slender shanks—wherever great strength is needed.

This toolmaker is putting the finishing touches on a striking punch of 67 Chisel. Having a hardness of Rockwell C-58, this tool must withstand considerable shock in producing an automotive part on a 50-ton press.

Punch and two-piece die for forming parts from 1/16-in. steel strip. Toughness was required here, but the user reports satisfaction with 67 Chisel because of its long-wearing properties, easy machining, and overall economy in production.

Tolerance on dies is kept within .0005 in.

**Hot-Work Applications:** Headers, piercers, forming tools, inserts for drop-forge dies, heavy shear blades, and the like. Having a good red-hardness value, 67 Chisel has many hot-work applications where the operating temperatures of the tool are below 1050 F.

**Outstanding Properties.** 67 Chisel is easy to forge, machine, and heat-treat. Here are typical results with a ¾-in. bar, hardened at 1750 F and oil-quenched:

| *Temper, F* | *Charpy, ft-lb* | *Rockwell C* | *Tensile, psi* |
|---|---|---|---|
| 400 (for cold work) | 180 | 56.5 | 315,000 |
| 1050 (for hot work) | 200 | 47 | 230,000 |

| | *C* | *Si* | *Cr* | *W* | *V* |
|---|---|---|---|---|---|
| *Analysis.* | 0.50 | 0.75 | 1.15 | 2.50 | 0.20 |

**Prompt Deliveries.** 67 Chisel is available in many standard sizes at our mill depot. Also stocked by many of our tool steel distributors. Get full details from the nearest Bethlehem sales office. Better still, order a test bar and see for yourself how tough 67 Chisel really is!

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
*Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

**67 Chisel . . . one of Bethlehem's Fine Tool Steels**

# REEVES ARMY TWILL

## "CUT OUT"

### for good looks and longer wear

REEVES ARMY TWILL is built to "take it"! Over 100 million yards of this versatile, high-quality, combed cotton fabric have been delivered to the Armed Services—exceeding rigid Government specifications.

Whatever your industrial requirements may be, you'll find Reeves Army Twill outstanding. It resists rough usage. It stands up under extreme laundering conditions. And it keeps a neater appearance longer.

**"FROM COTTON TO CUTTER"**

Reeves Army Twill is Sanforized—residual shrinkage is less than 1%. It comes in a wide range of vat-dyed colors fast to sun, water and perspiration. It is one of many durable fabrics made by Reeves for industrial purposes. Write for the names of manufacturers specializing in your industry.

**REEVES BROTHERS, INC.** 54 WORTH STREET, NEW YORK 13, N. Y.

REPRESENTATIVES IN: *Akron • Atlanta • Boston • Chicago • Dallas • Los Angeles • Philadelphia • Portland, Oregon • St. Louis • Montreal • Toronto*

# Caterpillar
# DOUBLES HOB LIFE

*Using*

**BARBER-COLMAN AUTOMATIC HOB SHIFTER ON No. 8-10 HOBBING MACHINES**

Caterpillar—builders of famous diesel "Cats" and a line of matched road building machinery — is getting reduced hob costs and better quality gear production from Barber-Colman No. 8-10 Hobbing Machines equipped with Automatic Hob Shifters. Because hob wear is automatically distributed more evenly by the Shifter, these No. 8-10 machines are now producing 132 gears per hob sharpening, compared with 66 gears per sharpening previously. Each of the three machines shown, operated in a battery, now runs for a full 12-hour shift, without shut-down for tool sharpening.

Another important factor in this job is the larger number of higher quality gears produced, as a result of the more even distribution of hob wear.

**JOB FACTS**

Operation — Climb Hob 8 D.P. Clutch Control Drive Gears, 2.875" O.D. x 5/8" face, 2 per load.

Fl-to-Fl Time — 11 gears per hour

Feed — .044"/rev. of work

Speed — 150 R.P.M.

Remarks — Former production run, 6 hours between sharpenings. Hobs now run 12 hours between sharpenings.

For high quality of work and reduced tool costs, Barber-Colman No. 8-10 hobbing machines provide the most recent improvements in gear cutting equipment. Write our sales engineering department for estimates on your gear cutting problems.

For details on the No. 8-10 Hobbing Machine, write for this new free Bulletin No. 117.

**Barber-Colman Company**

GENERAL OFFICES AND PLANT, 117 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

# Can you take advantage of this REAL ECONOMY?

**THIS 2" TURRET LATHE**

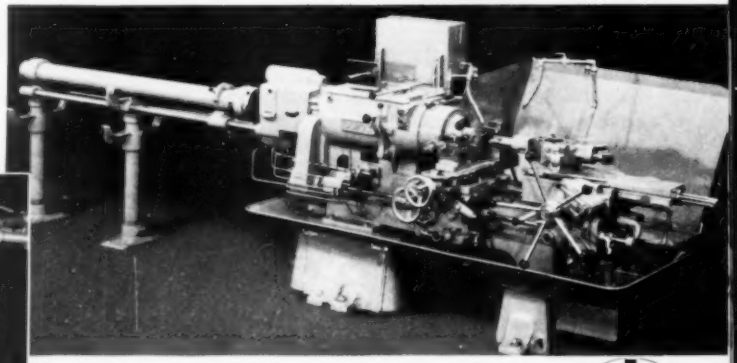
**HAS 4½" COLLET CAPACITY for tubing, plastics and lightweight bar stock**

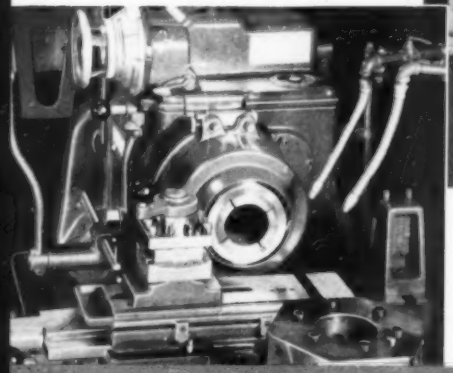
## GISHOLT No. 4 UNIVERSAL RAM TYPE TURRET LATHE

**You don't have to invest in expensive heavy-duty lathes to handle large diameter work of this nature. Here is the ideal lathe to machine tubing, plastics, or lightweight bar stock such as aluminum. You can use it for softer metals like brass, too.**

**The Gisholt No. 4 Ram-Type Turret Lathe (normally 2" bar capacity) can be furnished with a larger spindle bore providing 4½" round collet capacity. This machine gives you all the modern operating advantages which mean high speed production and low costs. It may be the economical solution to your problem. Ask your nearest Gisholt representative about it. Or write us for complete information.**

GISHOLT MACHINE COMPANY
*Madison 10, Wisconsin*





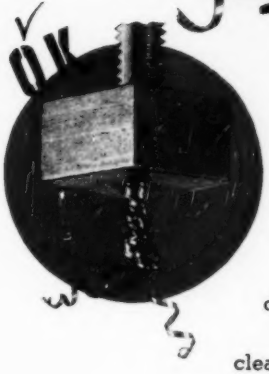
*The Gisholt No. 4 Ram-Type Turret Lathe with 4½" round collet capacity and equipped with 4½" bar feed. (At left) Close-up view of 4½" capacity collet chuck. This machine is ideal for large diameter tubing.*

**THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.**

GISHOLT

**TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES**

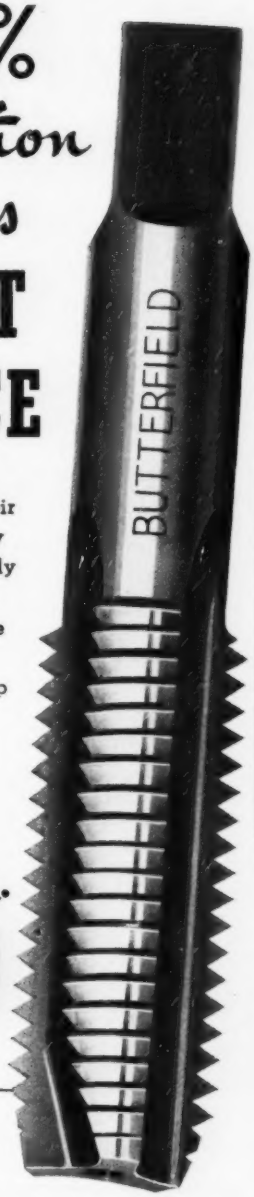
# Only 100% inspection insures PERFECT PERFORMANCE




Only when cutting tools have been given 100% inspection can you be *sure* of their top performance on the job. That's why every Butterfield spiral pointed tap is thoroughly checked so that it comes to you ready for your toughest assignments. Spiral pointed taps are designed for tapping deep through holes or blind holes drilled deeply enough to allow chip clearance at the bottom of the hole. They cut freely . . . produce excellent threads.

You can get quick deliveries of spiral pointed taps and other cutting tools from your nearby Butterfield Distributor ...he'll be glad to help you select the right tool for the job. BUTTERFIELD DIVISION, Union Twist Drill Company, Derby Line, Vermont, and Rock Island, Quebec.

Checking Pitch Diameter, Thread Form and Lead on a Zeiss Universal Measuring Microscope

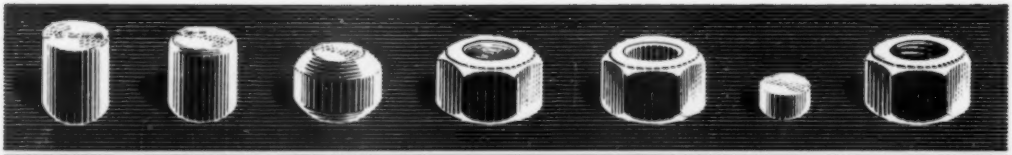



## BUTTERFIELD

**THE 100% INSPECTED TOOLS**

*Every Tool Individually Inspected*

TAPS • DIES • REAMERS • SCREW PLATES



# Inviting your inspection

BECAUSE Youngstown "Scrapless" Nut Wire is designed for modern cold-heading operations, it invites your critical tests. You'll find its sizing accurate and its composition correct. It measures up on chemical and metallurgical checks for analysis and micro-examinations.

Available in various compositions, including AISI standard as well as special sulphurized steels.

QUALITY YOUNGSTOWN SERVICE

# Youngstown

## "SCRAPLESS" NUT WIRE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

*Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices — Youngstown 1, Ohio

Export Office-500 Fifth Avenue, New York

WIRE - COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES.

# 10 Taps . . . *but only one Chuck!*

Collet changing is a thing of the past when a Jacobs Rubber-Flex Tap Chuck holds the tool. *One chuck takes all the taps in its range without the necessity of changing sleeves or collets!* The Jacobs No. 421-01 Tap Chuck, for example, has a capacity from #0 machine screw taps to 1/4" hand taps.

Light in weight and small in diameter, Jacobs Tap Chucks are designed to keep spindle inertia to a minimum. Rugged floating back jaws provide a sturdy positive drive. The Rubber-Flex Collet with its parallel bite provides the centralizing mechanism assuring extreme accuracy. External dimensions are ground and the internal bearing surfaces are precision bored. And tap changing is simplified—a quarter turn of the cap and the jaw screw disengages the tap from the chuck.

Stocked by your Industrial Supply Distributor. The Jacobs Manufacturing Co., Hartford 2, Conn.

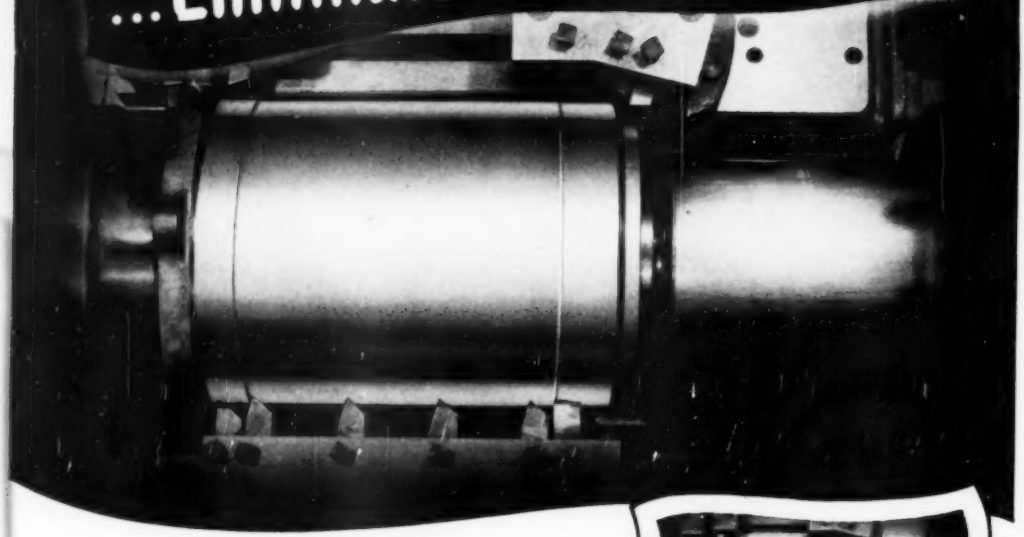
**If it's a JACOBS, it holds**

FOREMOST IN CHUCKS · FIRMEST IN GRIP

**Jacobs Chucks**

LODGE & SHIPLEY DUOMATIC LATHES at work...

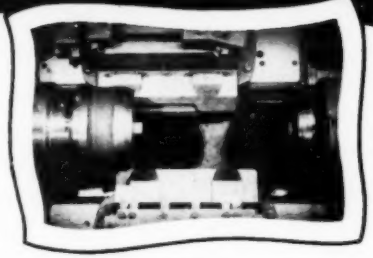
# ...Eliminate extra operation



USING a 3-A Duomatic (automatic) Lathe, to machine the exterior of diesel engine water jackets, Lodge & Shipley Engineers eliminated an extra operation and yet carefully avoided distortion of the thin-walled water jackets.

Ordinarily a multiple jaw expanding arbor would cause distortion and runout on a piece so thin. By using a special air operated driver and large centers, it was possible to face both ends during the turning operation—as a result, rechucking and distortion were both eliminated. Rough turn, face, chamfer and undercut were performed along the length of the water jacket. In another Duomatic, also equipped with the special driver, similar finish operations were done.

This installation, at the plant of a noted locomotive manufacturer, is another example of the way Lodge & Shipley Engineers further the turning capacity and productivity of Duomatic Lathes. If you have repetitive lathe work, the cost-cutting ability of Duomatics can work for you. Get details from your Lodge & Shipley Representative or write for Duomatic catalogs.



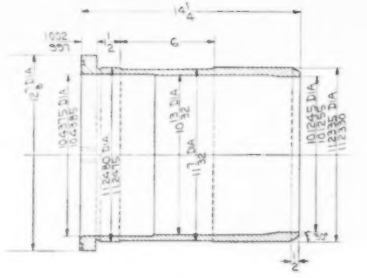
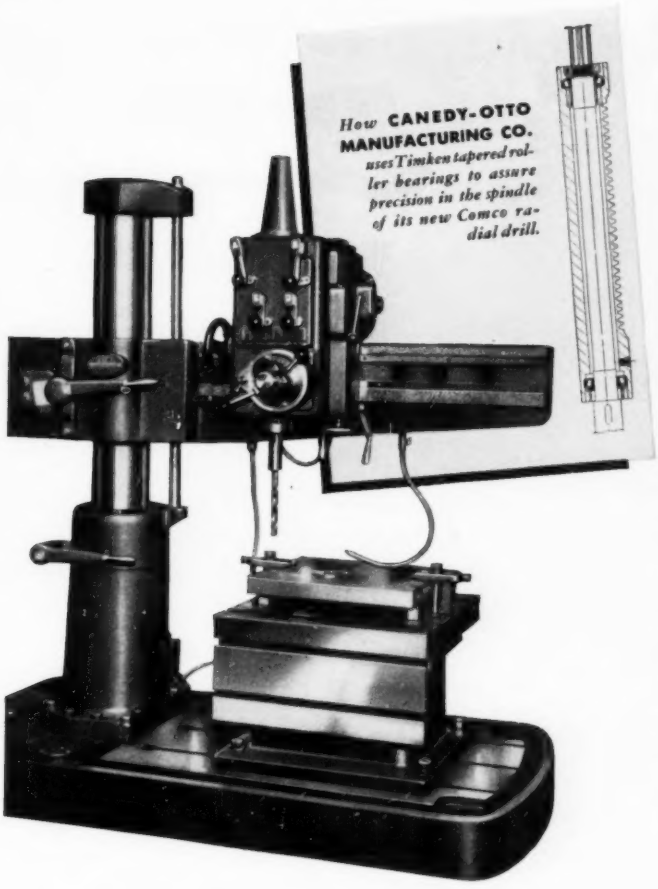


Illustration shows special rubber driver which prevented distortion of thin-walled diesel engine water jacket. Large centers supported workpiece, determined endwise location, and yet allowed the facing of both ends.

THE Lodge & Shipley COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
SPECIAL PRODUCTS DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

# One good turn after another—with TIMKEN® bearings on column and spindle


How CANEDY-OTTO MANUFACTURING CO. uses Timken tapered roller bearings to assure precision in the spindle of its new Comco radial drill.

THE new Comco radial drill, manufactured by the Canedy-Otto Manufacturing Co., Chicago Heights, Illinois, has a 3 ft. arm on a 7 inch column. To assure rigidity from base to drill point, the column and the spindle are mounted on Timken® tapered roller bearings.

Timken bearings on the column keep the drilling arm in accurate alignment despite the severe overhung load. Timken bearings on the spindle eliminate chatter, and further assure rigidity and precision.

Due to their tapered design, Timken bearings take both radial and thrust loads in any combination. Due to the line contact between rolls and races there's no chance of deflection. True rolling motion and incredibly smooth surface finish practically eliminate friction.

Made of Timken fine alloy steel, Timken bearings normally last the life of the machine in which they are used. Bearing wear is negligible; precision is retained for many years of service.

Timken bearings make better machines and *better selling* machines. They build greater acceptance for any machine because they are known and preferred the world over. So always look for the trade-mark "Timken" on the bearings you buy. And when buying new machine tools, be sure they're Timken bearing equipped. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

*This symbol on a product means its bearings are the best.*

**NEW TIMKEN BEARING CUTS RUN-OUT IN HALF!**

Until now, the Timken "Zero" bearing has been the last word in bearing accuracy. Now Timken offers industry the "Double-Zero" bearing—*twice as accurate* as the "Zero"! Maximum run-out of the new "Double-Zero" bearing is only 75 millionths of an inch—*half* the 150 millionths run-out of the "Zero" bearing.

What an opportunity for manufacturers of machines where extreme accuracy is essential! Available in standard single row types, up to 10" O.D. Write for further information.

**TIMKEN**

**TAPERED ROLLER BEARINGS**

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST ◫ LOADS OR ANY COMBINATION

# NO SHUTS OR FOLDS WHEN REDUCEROLLED!

Forging blanks are now pre-formed free of shuts and folds on the new National REDUCEROLL in a wide range of sizes and shapes as illustrated above.

Costly fullering and edging operations are eliminated, and the metal is distributed accurately, thus minimizing flash.

Additional advantages of REDUCEROLLING are increased production, and increased die life. The REDUCEROLL is portable, hence can be used as a "roving" tool. Low cost, quickly interchangeable rolls make short runs economical and practical. Rugged construction permits large reductions in area. REDUCEROLLING increases the range of your forging equipment ... does not require a skilled operator.

Why not let National Engineers help you investigate the application of REDUCEROLLING to your forging problems?

75th Anniversary 1874-1949

**NATIONAL**
**MACHINERY COMPANY**
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF
MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET AND WIRE NAIL MACHINERY

New York Detroit Chicago

WESTINGHOUSE GEARMOTORS

# NOW AVAILABLE FROM STOCK

YOU CAN BE SURE..
IF IT'S Westinghouse

Type A
Single-reduction

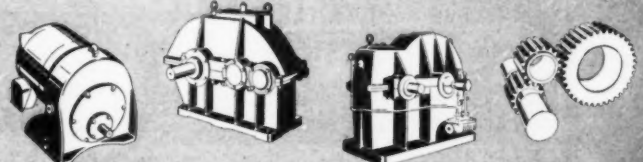
## WESTINGHOUSE NOW OFFERS IMMEDIATE DELIVERY ON POPULAR SIZES AND TYPES

Westinghouse Gearmotors are today's best answer for obtaining speed reduction on drive applications from 1 to 75 hp. And now, Westinghouse offers immediate delivery from stock. More than 50 sizes and types are available, comprising commonly used designs, and a few units with special auxiliary features. Many are powered by the revolutionary new Life-Line motor . . . the greatest advance in motor design in 58 years. Call your nearby Westinghouse representative for details on gearmotors available to fit your needs. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-07273

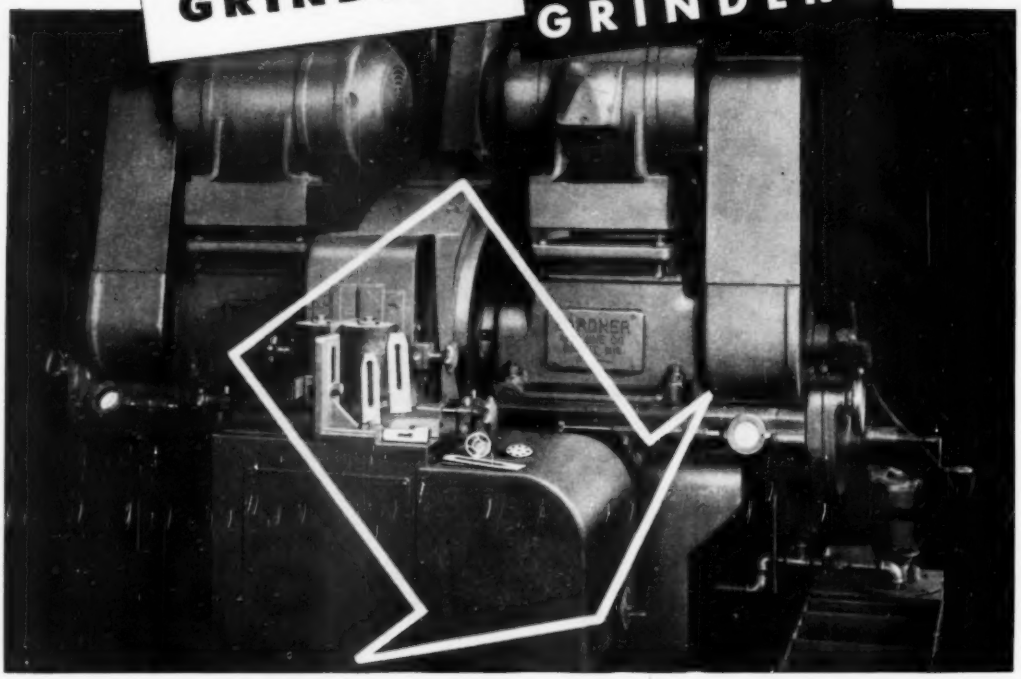
Westinghouse

RPM FITTED DRIVES



GEARMOTORS • SPEED REDUCERS • SPEED INCREASERS • INDUSTRIAL GEARING

FOR **FASTER GRINDING** USE **GARDNER *Double* GRINDERS**



SHOWN above, is one of many unusual parallel-surfacing jobs performed by the high-production "feed-thru" method — on GARDNER *Double* GRINDERS. Here, plane blades are fed to rubber rolls that guide them between opposed grinding wheels, where TWO sides are parallel-surfaced at ONE pass thru the machine. Food chopper blades also are fed thru this machine, on the same fixture, at the rate of 20 per minute.

*Use Modern GARDNER WIRE-LOKT Abrasives on YOUR Disc Grinders!*

For faster, lower-cost parallel-surfacing, investigate the advantages of GARDNER *Double* GRINDING.

**WORK DATA**

Part *Plane Blades*
Material *Steel*
Operation *Grind Two Parallel Sides*
Tolerances *Clean Up to Uniform Thickness*
Stock Removal *.012" to .015" Maximum Overall*
Production *4 to 6 Pieces Per Minute*
Feed *Hand Load to Rubber Feed Rolls*
Machine *No. 125-26" Gardner Double Grinder*

GARDNER-GRIND YOUR *Flat* SURFACES

WRITE FOR OUR *Double Grinder* BULLETIN!

**GARDNER MACHINE COMPANY**

410 East Gardner Street • • • • Beloit, Wisconsin, U.S.A.

# *Advanced Performance* 5 TO 1

## ON ACME·GRIDLEY CHUCKERS

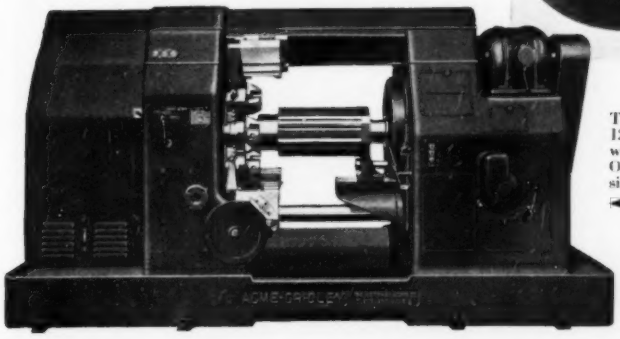
Among last month's shipments were 4 Acme-Gridley chuckers that will produce more parts per day than 20 single spindle machines.

That's what we mean by "advanced performance"—more good pieces in the pan—more finished parts per production dollar. You'll find the answer in the Acme-Gridley design.

From the floor up, model RPA hydraulic chuckers, like Acme-Gridley bar automatics, are *rugged*—built with balance, for permanent accuracy. And they're adaptable; with double indexing they'll finish both ends of a piece on one setup—or make two at a time.

Accuracy is insured by direct, positive camming. The speed comes from easy operation—and from the broad use of attachments, with a design that's built for carbide tooling.

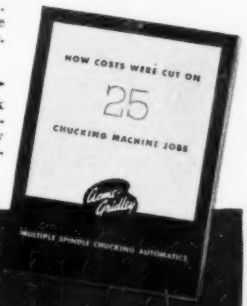
Those are the features that will help you lick the tougher competition to come—in '49. Ask for Acme-Gridley production figures; compare them with your present methods. The results will prove you can't afford to wait. May we help you?



**TYPICAL CHUCKING WORK**

This is the "Big 6"—12" chuck capacity, weight 68,000 lbs. Other 4-6-8 spindle sizes from 5¼" up.

Ask for this book showing tool layouts on many moneysaving applications.




# The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

LARGEST BUILDERS OF MULTIPLE SPINDLE BAR AND CHUCKING AUTOMATICS

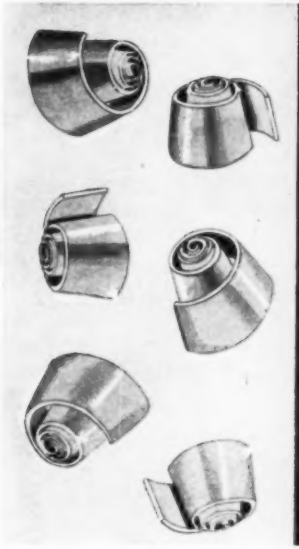
*it's the new*

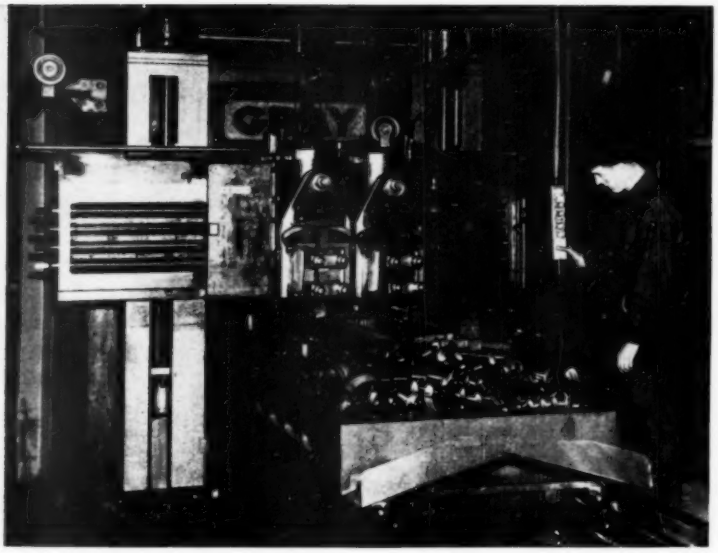
# GRAY

## SWITCH and FORGE PLANER FOR EXTRA HEAVY WORK...

Heavy roughing cuts 2 to 3 inches wide—2 heads—large railroad rails and switch-points—and 'round-the-clock operation demand enormous rigidity, power, and trouble-free performance.

The new Gray Switch and Forge Planers are designed for just such jobs.





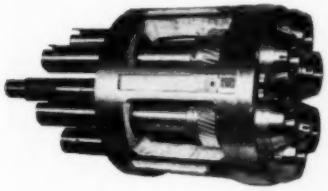
The G.A. GRAY Company

planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.
SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

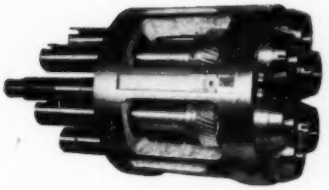
# MAINTENANCE BEGINS WITH DESIGN

**Buyers look for the "hidden dollars saved" in good Machine Design. They know it pays to see beyond a purchase price that might turn out to be a mere down-payment. Upkeep and replacements can be very costly.**
**Builders of multiple spindle automatics know the importance of a well-designed work spindle carrier. It has been referred to as the "heart" of accuracy. If you are an automatic user, you can quickly check on the maintenance dollars to be saved through the design of the Conomatic Carrier.**



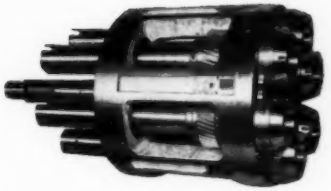
**INTEGRAL**
**DRUM TYPE**

Heavily ribbed, integral, drum shaped design, for adequate resistance to torsion strain under the heaviest of loads.



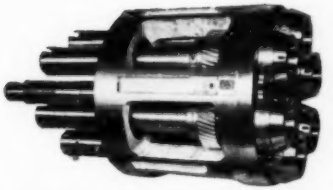
**GREATER**
**LENGTH**

Greater length, for better alignment of work and for greater bearing area of work spindles. Driven gears in balanced position for better distribution of load on spindles and bearings.



**TAPERED**
**FRONT BEARING**

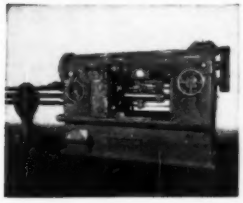
Exclusive tapered front bearing for the only combination radial and end thrust take-up facility provided by any multiple spindle automatic carrier. It is an important safeguard against deflection.



**FREE OF**
**CROSS SLIDE PRESSURE**

Rugged support of work, and relief from cross slide pressure by the block measurement positive stop provision against the machine frame, insure the maintenance of form tool and endworking tool operations to closer limits and quality finish.

#4



*A comparison with ALL Automatics*
*will lead you to*

**Conomatic**

CONE AUTOMATIC
MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

# The Hardest Possible Metal Sawing

. . . cutting off test specimens in the Metallurgical Laboratory of this giant steel plant. There is no time for pampering here. Each saw must handle anything that comes, as it comes — the hardest steels and toughest alloys, in all degrees of hardness — in any size, any form or condition — because each heat, each drawing, and each forming run has to be tested.

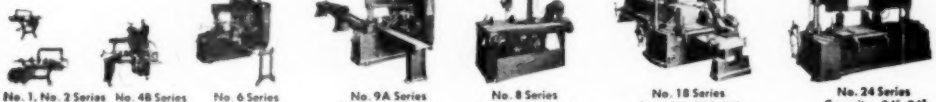
The steel mill where these pictures were taken reports that these saws have been operating 24 hours, 7 days a week for the last five years. Maintenance cost has been practically non-existent. Furthermore, the efficiency of these saws has made possible the elimination of an equal number of other sawing machines in the department.

The answer to your cut-off problem, whether large or small, will be found in our new C48 catalog. The services of our field engineers are also available in every locality. Send for either or both now.

**ARMSTRONG-BLUM MFG CO.**

*"The Hack Saw People"*

5700 BLOOMINGDALE AVE. CHICAGO 39, U.S.A.



No. 1, No. 2 Series Capacity: 4"x4" Capacity: 6"x6"

No. 4B Series Capacity: 6"x6"

No. 6 Series Capacity: 6"x6"

No. 9A Series Capacity: 10"x10"

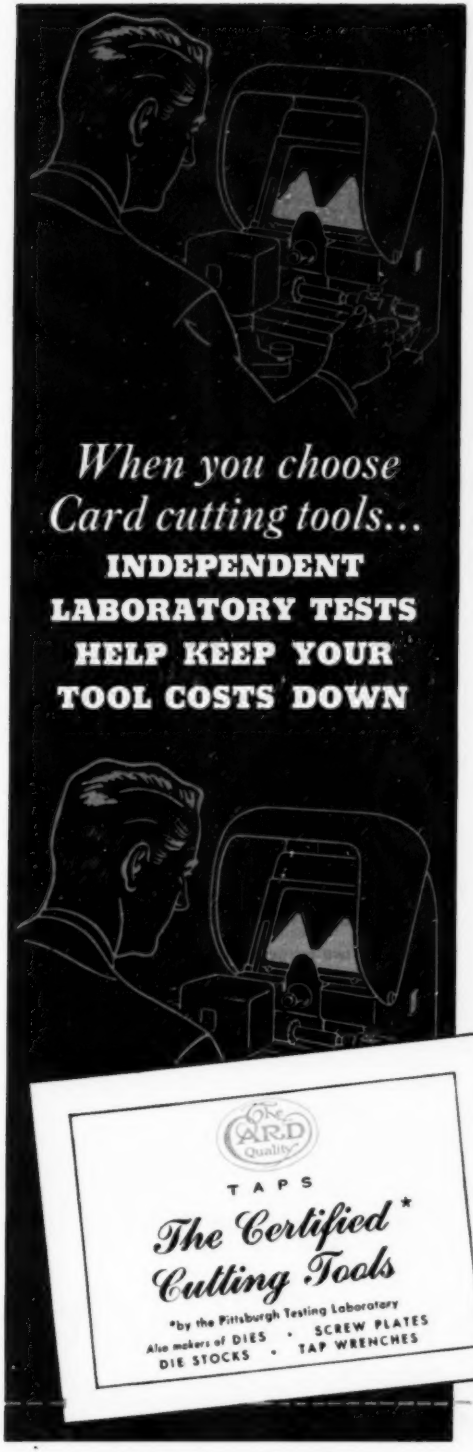
No. 8 Series Capacity: 18"x18"

No. 18 Series Capacity: 18"x18"

No. 24 Series Capacity: 24"x24"

MARVEL *Metal Cutting* SAWS

Better Machines-Better Blades

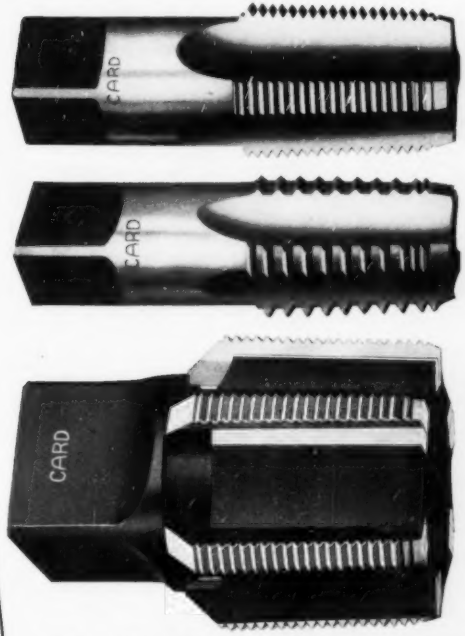



WHEN our tool inspectors put their "OK" on Card cutting tools we don't take their word for it!

Although we make Card tools meet the highest standards in factory inspection, we've engaged the famous Pittsburgh Testing Laboratory to make independent tests of our taps which they buy on the open market... just as you do. The results of their tests for hardness and dimensional accuracy are then *certified.*

This means that when you invest in a Card tap, you've got that *extra assurance* of quality that means top performance on the job.

And for prompt service . . . your nearby Card Distributor is set up to fill your needs to perfection.

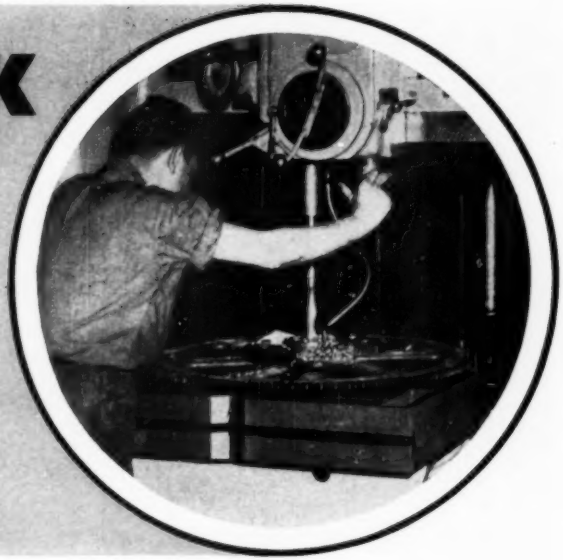


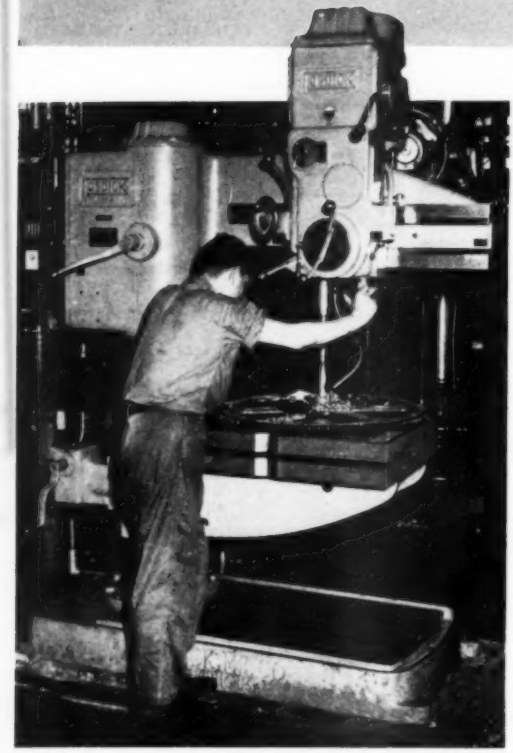

# S.W. CARD

**MANUFACTURING COMPANY**
**Mansfield, Massachusetts**
*DIVISION OF UNION TWIST DRILL CO.*

# FOSDICK SENSITIVE RADIAL DRILL

*Increases the range of Sensitive work*





● The advent of this extremely flexible machine has opened a new and wider field for sensitive drilling work.

It is very much like a conventional radial except that it has the arm at a fixed height from the base and also features an adjustable table on the column. Both the arm and the table swing in an arc of 360°. There are many advantages to this adjustable table design—table is always in proper position for work being handled—the work can always be close to head with minimum spindle extension—the table can easily be swung out of the way to handle a tall work piece mounted on the base.

There are two ranges of spindle feeds (high)—from .004 to .020 and (low)—from .002 to .010. Spindle speeds are available in 6 combinations ranging from 60 to 1200 up to 175 to 3500.

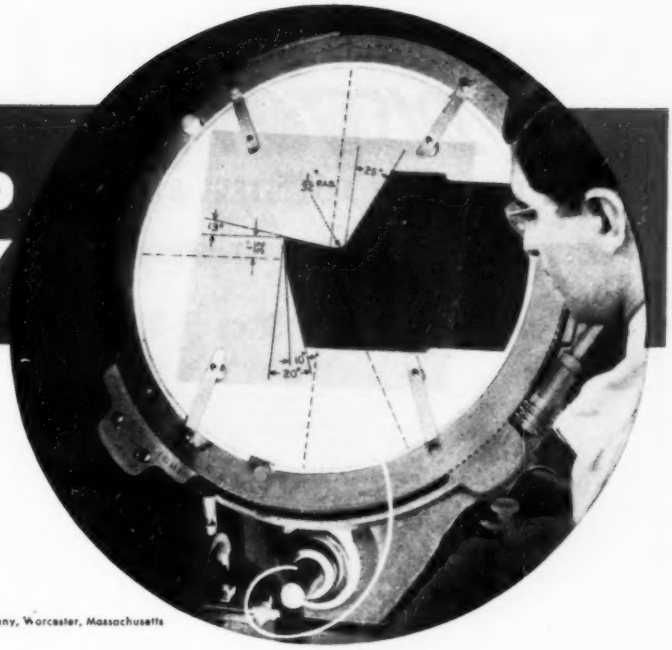
The machine finds many uses both in large and small plants due to its adaptability to such a wide range of sensitive drilling operations and the flexibility of its radial design.

The machine shown is operating in the plant of the Slocomb Corporation, Wilmington, Del.

*For full details write for Fosdick Sensitive Radial Bulletin S R A.*

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO

# VERIFIED ACCURACY



Inspecting a precision lapped cutting tool on a Jones & Lamson Optical Comparator.

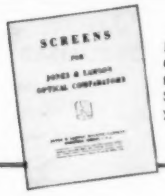
Photograph courtesy The Heald Machine Company, Worcester, Massachusetts

The Heald Machine Company, maker of precision finishing machines, uses *Jones & Lamson Comparators to verify, quickly and easily, the exact reproduction of tool shape specifications, obtained by lapping on their precision lapping machines.*

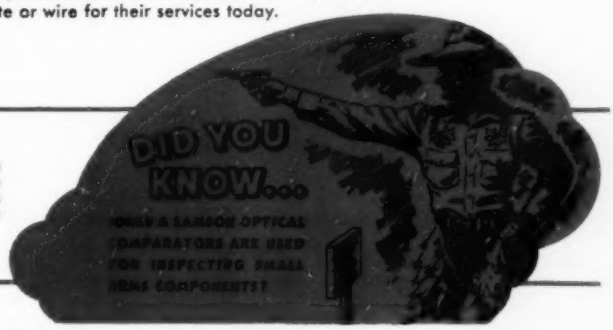
Inspection with Jones & Lamson Comparators leaves no room for doubt; the evidence is positive, conclusive and clearly visible.

Many components and products formerly inspected by slow tedious methods, that retarded production and drained profits, are now inspected in seconds or minutes on Jones & Lamson Comparators, by operators with only a minimum of instruction. Savings are made all along the line, in gage cost, in time and in overhead.

Our engineers are inspection specialists; their knowledge of holding fixtures, handling methods and suitable Comparator equipment has saved hundreds of thousands of dollars throughout the country. Call, write or wire for their services today.




Every owner of a Jones & Lamson Optical Comparator should have this catalog of Standard Glass Screens. Write to Dept. 710 for your copy.




*Optical Comparator Division*

**J&L JONES & LAMSON MACHINE COMPANY**
Springfield, Vermont, U.S.A.

*MACHINE TOOL CRAFTSMEN SINCE 1835*

# Save steel, work and time with DISSTON HOT ROLLED TOOL STEEL SHAPES

Why pay for all this Bar Stock . . 38 oz.

To get this..17 oz. WHY NOT START HERE!

To make this Vise Jaw Insert . . 13¾ oz.

Disston Hot Rolled Shapes can save you up to 50% or more on the tool steel you now use. By using the hot rolled shape shown above the saving in steel amounts to 55.26%. And, even more important, there is a saving in machining time, for these Disston shapes are rolled to close tolerances.

Disston Hot Rolled Shapes are supplied in many forms and sizes . . . in alloy and carbon tool steels . . . in electric and open hearth grades.

Send us dimensional sketches of the shapes you use, together with the analysis and approximate quantities desired. Full particulars will be sent to you promptly.

Disston metallurgists and engineers will be glad to help you solve any of your tool steel problems.

No. 974½ Machinist's Vise, a product of the Charles Parker Co., Meriden, Conn.

## ANALYSIS OF STEEL USED

| | |
|---|---|
| CARBON | .45/.55 |
| MANGANESE | .60/.90 |
| PHOSPHORUS and SULPHUR | .040 max. |
| SILICON | .20/.35 |
| CHROMIUM | .80/1.10 |

**STEEL:** Everybody who wants to obtain steel can help himself to get it by immediately starting scrap into the channels that serve steel mills.

**HENRY DISSTON & SONS, INC., 220 Tacony, Philadelphia 35, Pa., U. S. A.**

A N N O U N C I N G

*THE*

# NEW

## *IMPROVED SOL-SPEEDI-DRI*

OUT OUR WAY

THAT NEW SOL-SPEEDI-DRI SURE SEEMS LIGHTER AND FLUFFIER!
YEP, AND THE NEW SOL-SPEEDI-DRI COSTS LESS TO USE BECAUSE IT COVERS MORE AND ABSORBS MORE!
TAKES A BIGGER BAG NOW FOR SOL-SPEEDI-DRI 'CAUSE THERE'S MORE TO EVERY POUND!
THE PEOPLE WHO PRODUCE SOL-SPEEDI-DRI AIN'T ASLEEP! THEY MAKE SOL-SPEEDI-DRI BETTER AND BETTER ALL THE TIME
BIGGER AND BETTER
J.R.WILLIAMS
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***NEW SOL-SPEEDI-DRI***
Gives You *More Volume* Per Pound

***NEW SOL-SPEEDI-DRI***
*Covers More* Floor Area Per Pound

***NEW SOL-SPEEDI-DRI***
*Absorbs More* Liquids Per Pound

## WRITE FOR THE FACTS!

Yes, Sol-Speedi-Dri — the new, improved Sol-Speedi-Dri — is here! And it is more economical to use than ever before, because you get more bulk, more coverage, more absorption, per pound.

**WHEN YOU BUY, BE *SURE* IT'S SOL-SPEEDI-DRI!**

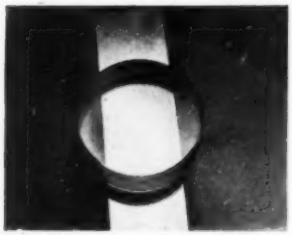
SAFETY & MAINTENANCE CO., Inc., 1 Wall Street, New York 5, N.Y. Warehouse stocks maintained in principal cities of the United States and Canada.

***SOL·SPEEDI·DRI***
**THE ORIGINAL ABSORBENT FOR ALL LIQUIDS**

# Van Keuren OPTICAL FLATS
## are the proof of Precision

BOSTON

NEW YORK



*Detecting worn spot on amplifying gage anvil.*

IF the 10" diameter Van Keuren Master Flat shown above were extended from New York to Boston, the surface would deviate from a true plane less than 1".

Insist on having Van Keuren Fused Quartz Optical Flats. They are beautifully finished and are of superlative accuracy on both sides. They are the best buy.

*Checking flatness of lapped shoulder on a shaft with a special 3" diameter x 29/32" hole Fused Quartz Optical Flat*

**IF YOU HAVE A PROBLEM**
*of testing flat surfaces, send us a sample part for examination and report.*

THIS 208-page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

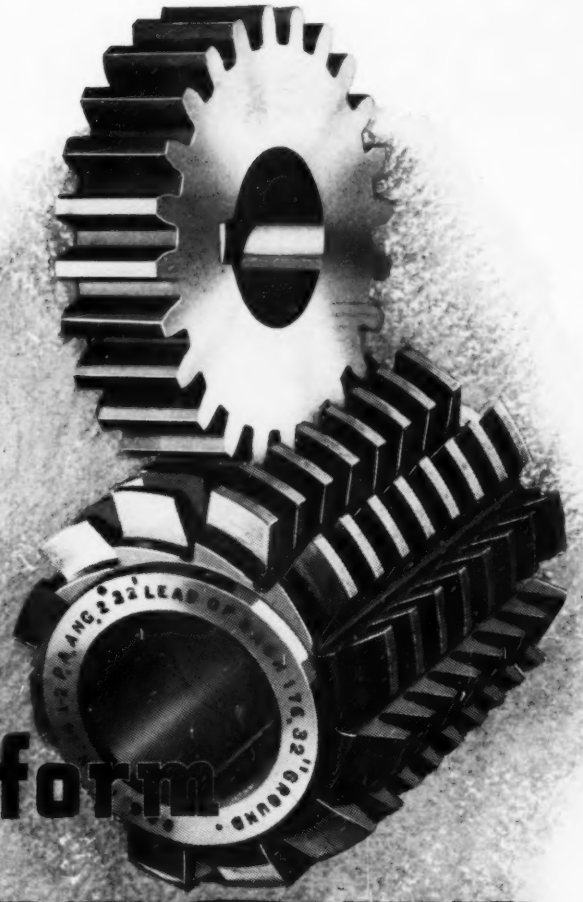
*Copies free upon request.*

THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

30th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

# no other hob will outperform a UNION



See Catalog R
for various types of hobs

## contact your local distributor

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

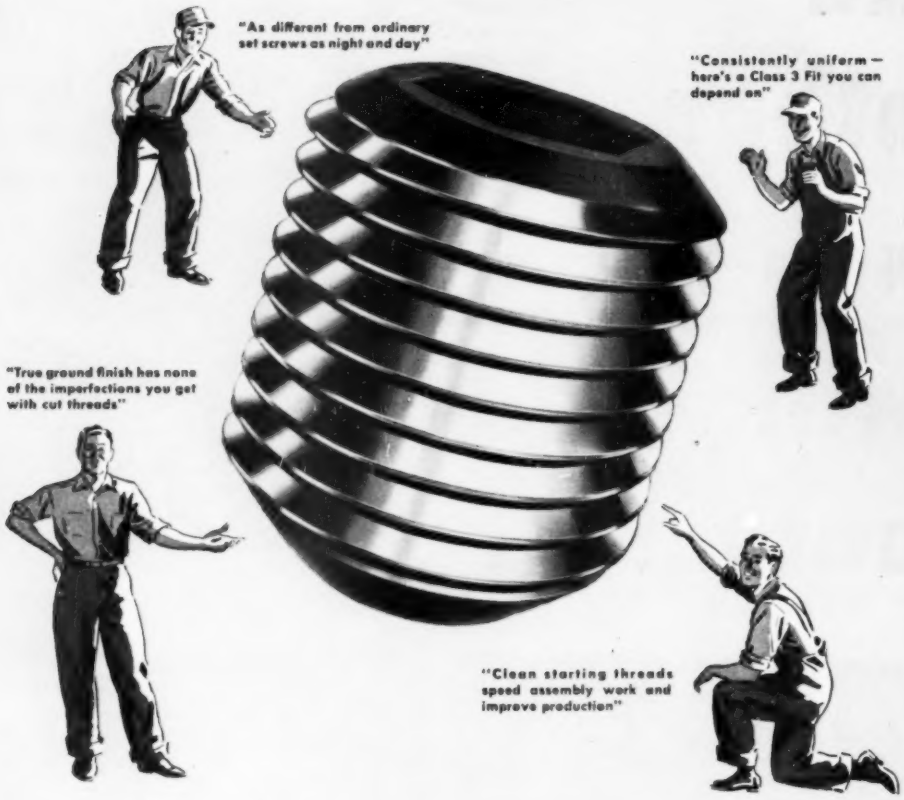
MILLING CUTTERS • GEAR CUTTERS • TWIST DRILLS • HOBS • REAMERS • CARBIDE TOOLS

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass., Taps, Dies, Screw Plates.

BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers.

BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.

# Parker-Kalon GROUND THREAD Socket Set Screws are The TALK of the SHOP!


"As different from ordinary set screws as night and day"
"Consistently uniform — here's a Class 3 Fit you can depend on"
"True ground finish has none of the imperfections you get with cut threads"
"Clean starting threads speed assembly work and improve production"

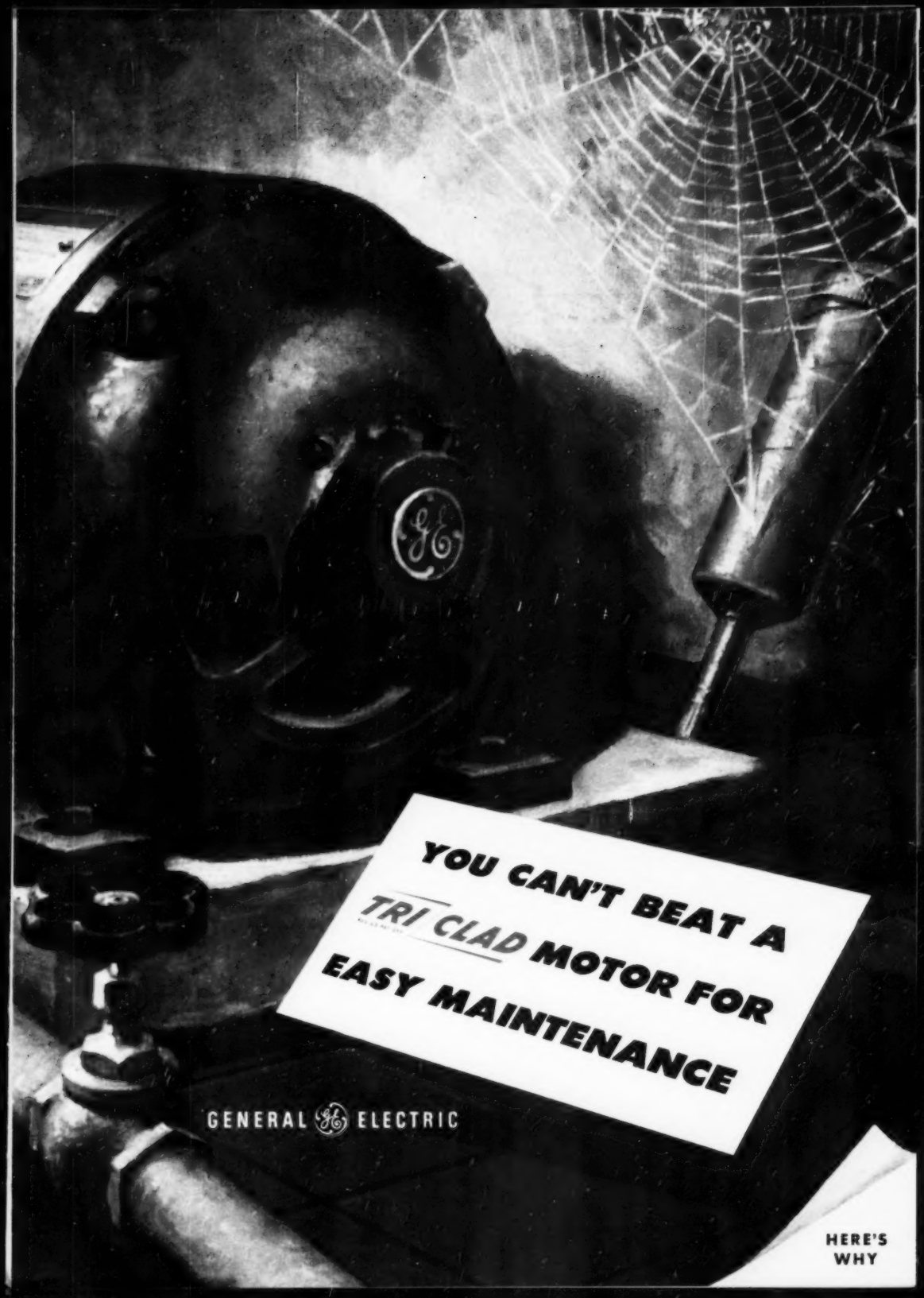
## Compare! Write for Samples!

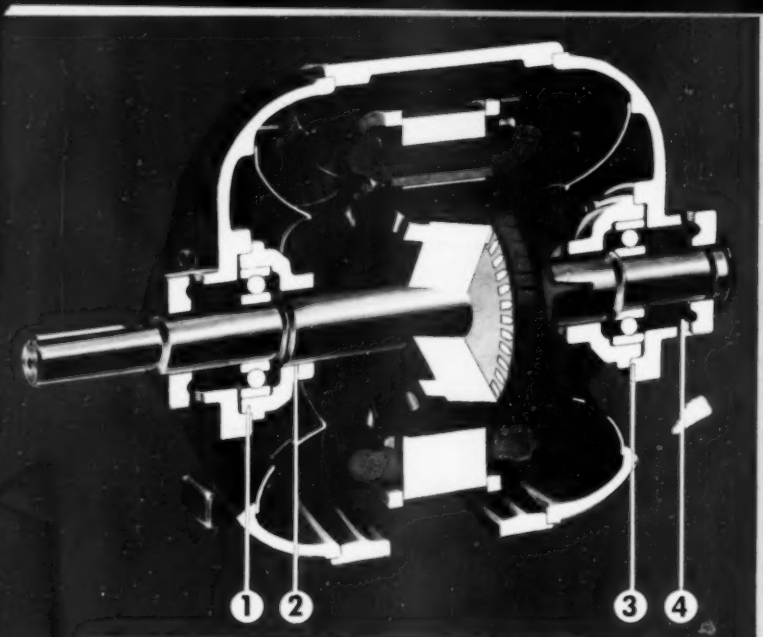
See why P-K Ground Thread Socket Set Screws speed assemblies, improve strength and safety. Thread grinding, once reserved for screws used in the finest precision equipment, now gives Parker-Kalon Socket Set Screws the accurate finish and faultless contour that mean faster assembly and more sales for your products. Write for samples today.

AVAILABLE FOR PROMPT DELIVERY

**PARKER-KALON CORPORATION**
**200 Varick Street**
**New York 14, N. Y.**

SOLD ONLY THROUGH ACCREDITED DISTRIBUTORS


YOU CAN'T BEAT A
TRI CLAD MOTOR FOR
EASY MAINTENANCE
GENERAL ELECTRIC
HERE'S
WHY




Notice (1) how Tri-Clad bearings are surrounded by and rigidly supported in solid cast-iron housings. Compare the long, close-running fit between housing and shaft (2) with other motor bearings. Examine the tight rabbet fit between inner cap and end shield (3) which keeps dust and moisture out and lubricant in. See, too, the pressure-relief greasing system (4) that makes it easy to lubricate if you need to.

## You can't beat a TRI CLAD motor for easy maintenance

**A TRI-CLAD MOTOR** will run safely without lubrication for years—for as long as any other general-purpose motor you can buy. The big thing is—it's *grease-gun easy* to lubricate a Tri-Clad if you need to.

You don't have to take a Tri-Clad motor down and disassemble the bearings to lubricate it. You don't have to follow special instructions. A standard gun and a good grease are all you need.

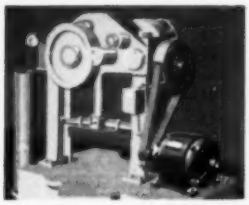
And remember, Tri-Clad gives you all the extra protection that only cast-iron structure can give . . . Extra protection against rust and corrosion . . . Extra protection against mechanical abuse and permanent distortion . . .

*Extra protection that has been proved in more than 5 billion hours of rough-and-tumble industrial service.*

**WANT TO SEE FOR YOURSELF?** Tri-Clad motors in nearly all types and ratings are ready for **IMMEDIATE SHIPMENT.** Contact your nearest G-E Office or write *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

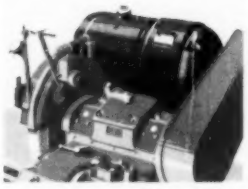
## There's a Tri-Clad motor for every industrial need!



**G-E open (drippproof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.**

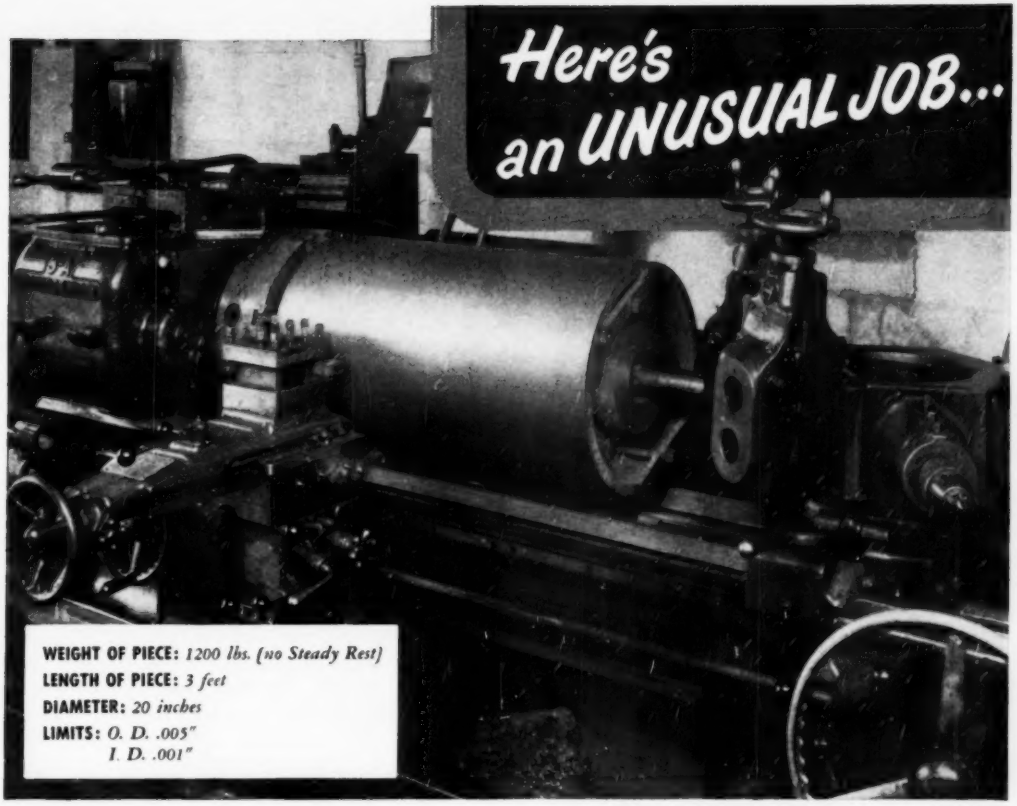
**G-E totally enclosed motors for operation where dust or corrosive fumes are a hazard. From 1 to 1000 hp.**

**G-E capacitor motors for use on fans, blowers, pumps and compressors with single-phase power. From ¾ to 5 hp.**



**G-E Type ACA induction motors for adjustable speeds—provide 3 to 1 speed range. From 3 to 200 hp.**

YOU CAN'T BEAT TRI CLAD EXTRA PROTECTION




## ...DONE ON A STANDARD WARNER & SWASEY 3-A TURRET LATHE

THE Haley Machine Company of Springfield, O., contracts to produce massive coal-crusher rolls.

These dense cast iron rolls weigh 1200 pounds each. They are 36" long and 20" in diameter. The two hub bores, 6" and 9" long, must be finished to .001", and the O.D. to .005". All diameters must be held concentric within .005".

The roll was gripped internally and machined with no steady rest . . . held securely by the 3-jaw scroll chuck and two light tie rods. Two chuckings were needed, one for each end.

All limits were held, with an excellent finish obtained. The surprisingly fine results have assured Haley production men that this job can be done profitably on a Warner & Swasey Turret Lathe.

The size and weight of this job, demanding smooth finish and unusually close limits, clearly shows the extreme rigidity and accuracy built into each Warner & Swasey Turret Lathe. Why not find out how this rigidity and accuracy can help you solve your turning problems. Call the nearest Warner & Swasey office or write—

*You can machine it better, faster, for less.. with a Warner & Swasey*

WARNER & SWASEY
Machine Tools
*Cleveland*

TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

# ARMSTRONG

## Drop Forged "C" CLAMPS

### More Reliable...

Every characteristic essential to absolute reliability is built into ARMSTRONG Drop Forged "C" Clamps—maximum strength, extreme stiffness, extra large Tempered and Tested Screws, better "Tool Sense" and design.

That is why it is good policy to standardize on ARMSTRONG "C" Clamps . . .

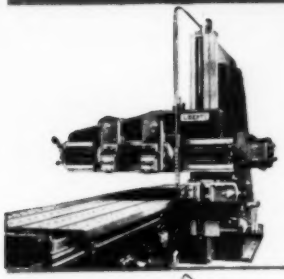
Your local ARMSTRONG dealer carries them in "Heavy Duty", "Medium Service", "Extra Deep Throat", "Spatter Resisting" and "Toolmakers" designs in a wide range of sizes.

*Write for New S-48 Catalog*
*JUST RELEASED*

ARMSTRONG BROS. TOOL CO. "The Tool Holder People" 5213 W. Armstrong Ave. CHICAGO 30, U.S.A.

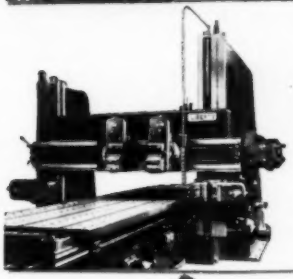
NEW YORK • SAN FRANCISCO

# LIBERTY BUILDS 3 *great* PLANERS



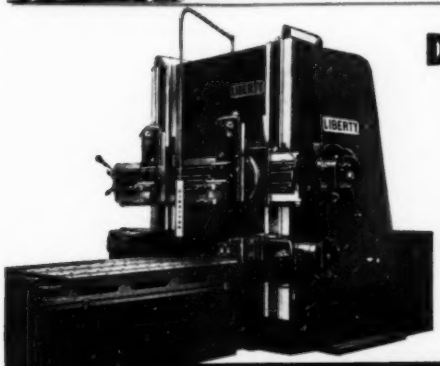
## OPEN SIDE

For shops handling work of variable widths. Wide-faced housing and motorized clamp give rigidity for heavy roughing cuts and finishing. Dual control; electric feeds; rapid traverse to all Heads in all directions.



## CONVERTIBLE

For exceptional rigidity on variable widths. Two, three or four heads. Offset heads permit closest approach of tools. Double balanced driving gear and pinions. Extreme accuracy.




## DOUBLE HOUSING

For rapid production combined with accuracy. Two, three or four heads. Extremely rigid; handles production work with maximum cutting feeds and speeds. Table pulled into tool. Electric clamping and dual control for ease of operation; high production.

***Write for catalog giving complete details.***

All lengths, 24" x 24" wide and larger.

**LIBERTY PLANERS, INC.**

**HAMILTON, OHIO**

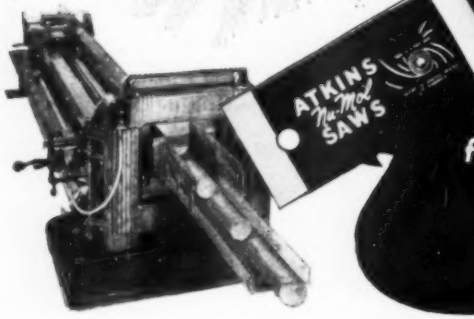
**GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 W. MADISON ST., CHICAGO 6**

***Exclusive Representatives in All Principal Cities***

# ATKINS Announces

## THE *Nu-Mol*

## POWER HACKSAW BLADE




*A New and Better Power Hacksaw Blade for High Production Cutting of Lower Alloy Steels*

**LOOK at These Typical NU-MOL Performance Reports**

| | |
|---|---|
| NM 614P | 249 pcs. 1" rd. SAE 4140 |
| NM 4714 | 8 machines, 1 blade each 35,000 sq. in. 4½" sq. 1045 |
| NM 6718 | 9 hrs. continuous cutting stainless steel. |

Twenty-five years ago Atkins introduced the first high speed steel hacksaws to be made in the United States. Today, in their field, Atkins "Silver Steel" Hacksaws are still the finest blade made . . . excellent for sawing any of the high carbon, tough jobs, or any other steels that can be cut with hacksaws.

NOW, in the field of sawing lower alloy steels, where high production cutting is essential, the NU-MOL rounds out the Atkins line of blades that covers every type of hacksaw requirement.

NU-MOL is the result of years of metallurgical research, from which have developed new methods of manufacturing and heat treating.

NU-MOL is a tough, yet exceptionally flexible power hacksaw blade. It reduces blade breakage to a minimum. Its teeth stay sharp longer with little chipping. Resistance to abrasive action is excellent.

NU-MOL cuts fast and clean to extremely close tolerances. NU-MOL reduces your costs due to longer blade life.

Find out what NU-MOL can do for you. Ask your Industrial Distributor to demonstrate the new NU-MOL performance on your own cutting jobs. Get in touch with him today.

NU-MOL Power Hacksaw Blades are Packaged 10 to a Box.
Available in all standard lengths and tooth sizes.

**ATKINS**

**E. C. ATKINS AND COMPANY** • *Home Office and Factory:* 402 S. Illinois Street, Indianapolis 9, Indiana
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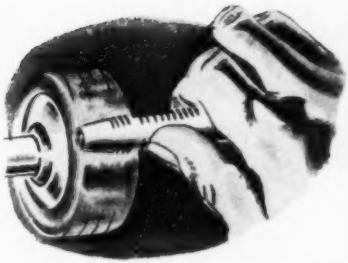
AAA TRADE MARK ATKINS "ATKINS ALWAYS AHEAD"

**MAKERS OF BETTER SAWS FOR EVERY CUTTING JOB**

# BETTER FINISHES...

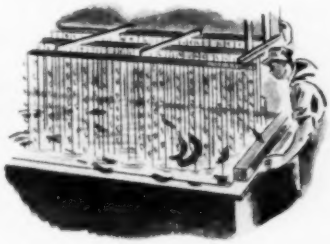
**MECHANICAL FINISHES...**

polished, buffed, scratchbrush, satin, sandblasted, tumbled, burnished . . . aluminum takes all of them.



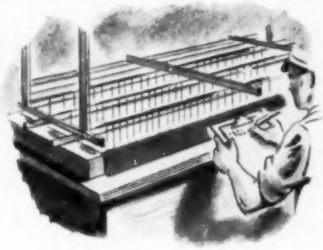
**CHEMICAL AND ELECTROCHEMICAL FINISHES...**

frosted, etched, and patented Alumilite and Alrok finishes give unusual effects in lustre and color . . . add resistance to corrosion and wear . . . provide excellent painting surfaces.



**ELECTROPLATING...**

aluminum parts, after suitable surface preparation, take chromium, nickel, gold, silver, copper and brass plating with standard equipment.



**PAINT, LACQUER AND ENAMEL FINISHES...**

all may be applied following the general techniques used for painting other metals ... good surface preparation, priming, etc.

## Another reason for making the most of your Alcoa Aluminum Screw Machine Stock

In making the most of the Alcoa Aluminum Screw Machine Stock available, add to your bonuses of fast machining, high economy and peak performance, another advantage . . . the variety of finishes you can apply. Only aluminum takes the Alcoa patented Alrok and Alumilite finishes that seal vivid colors in the metal surface, add extra wear resistance. Painting and plating finishes require only standard equipment.

It pays to use Alcoa's help in making aluminum do an exceptional job on your parts. Learn the finishes that best suit each screw machine alloy. Start by asking for copies of "Finishes for Alcoa Aluminum" and "Alcoa Aluminum in Automatic Screw Machines". Your nearby Alcoa sales office will supply you, or write ALUMINUM COMPANY OF AMERICA, 1709 Gulf Building, Pittsburgh 19, Pa.

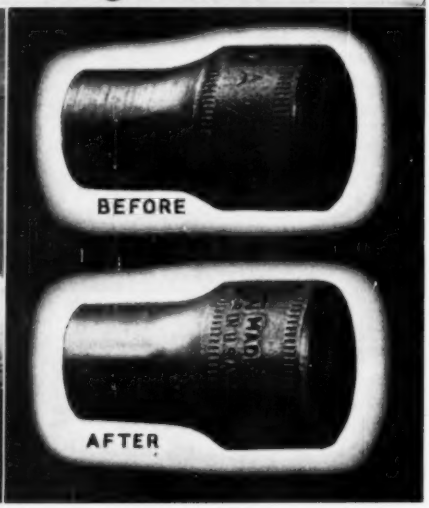
GOOD MACHINING PRACTICES SAVE METAL

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM

# *Remove heat scale and improve finish- in one operation*

## with ALUNDUM Tumbling Abrasive




A tool manufacturer removes heat scale from 5,000 steel sockets for ratchet wrenches in approximately 3 hours, by tumbling them with ALUNDUM abrasive. This clean, economical process not only thoroughly removes objectionable heat scale, but also removes all tool marks, improves the surface of the sockets, and prepares them for subsequent plating operations.

By taking advantage of precision tumbling and ALUNDUM abrasive, this manufacturer eliminates the danger of pitting the surface of the parts with acid dip methods used previously, eliminates slow, expensive polishing operations, and obtains cleaner, better-surfaced parts quickly and economically.

ALUNDUM Tumbling Abrasive is an ideal tumbling medium for operations used to deburr, to remove scale, plating and paint, and to improve surface finish. For full details on this NORTON abrasive product, contact your NORTON abrasive engineer or distributor, or write for a free copy of the fact-packed booklet, "Precision Tumbling with ALUNDUM Abrasive."

**NORTON COMPANY • WORCESTSER 6, MASS.**

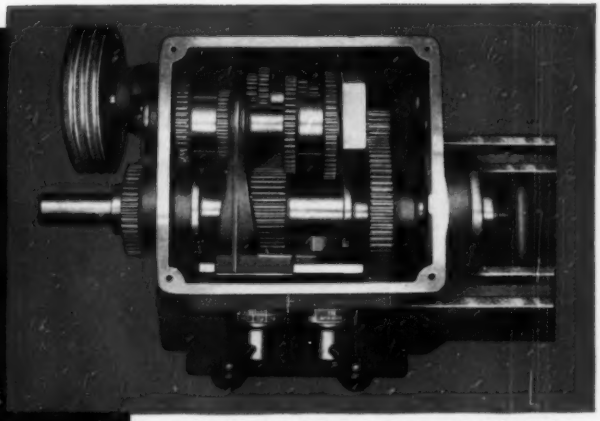
***Distributors In All Principal Cities***

G-205

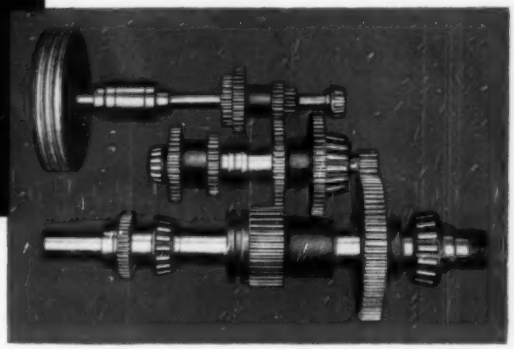
NORTON ABRASIVES

# More Powerful Head

- ✓ Oversized Heat-Treated Steel Gears
- ✓ Timken Tapered Bearings
- ✓ Unusually Large Spindle, Rigidly Mounted
- ✓ Rugged Shifting Mechanism
- ✓ Extra-Heavy Casting
- ✓ Automatic Splash Lubrication

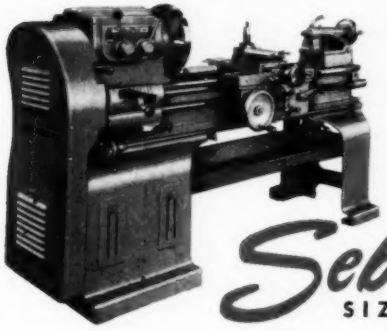


**SEBASTIAN 8-SPEED GEARED HEADSTOCK**
Interior view showing sliding gear transmission.



Timken Bearings and heat-treated steel gears on all headstock shafts assure more power, longer service life.

The above special headstock features assure more power, extra-high accuracy, and exceptionally low maintenance in the modern "King-made" Sebastian Lathe. In addition, the following features provide a superior ease and all-around efficiency of operation which make this *finer* Sebastian an outstanding leader in the medium-price engine lathe field:



Shaved headstock gears for quiet operation . . . Neutral point in head permits revolving spindle freely by hand for chucking work . . . Large hole through spindle . . . Headstock completely sealed . . . Multi-colored, direct-reading control dials for obtaining spindle speeds quickly and easily . . . Reverse in apron for feeds—adds to operating convenience . . . 57 feed and thread changes . . . Taper gibs . . . Apron control for start, stop, and reverse of lathe spindle (standard on lathes with 10′, 12′, and 14′ beds—optional on other bed sizes).

SEBASTIAN DEALERS ARE LOCATED IN PRINCIPAL INDUSTRIAL CENTERS

## Sebastian GEARED HEAD LATHES

SIZES 12", 16", 20"

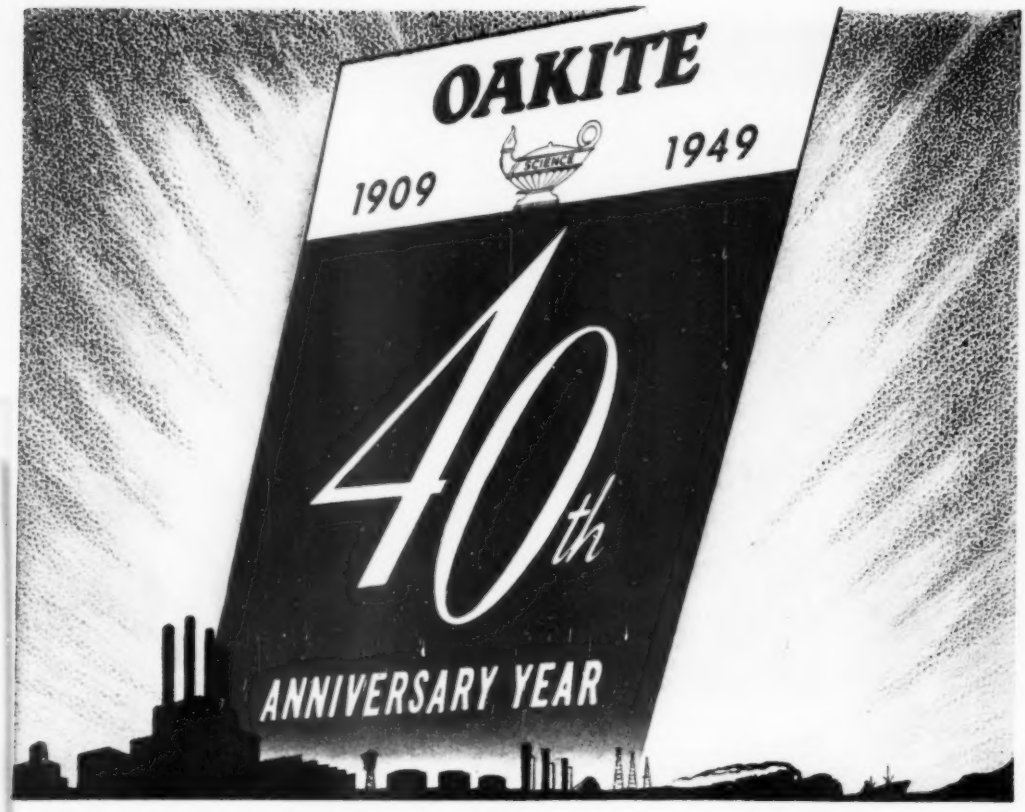
See your nearest Sebastian Dealer. Ask him or write us for Catalog S-1 (Standard Lathes) and S-101 (Special Type Lathes —Gap, Clutch & Brake, etc).

**American Steel Foundries**

## KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

*Builders of King Vertical Boring & Turning Machines and Sebastian Lathes*




*Who can foretell...* **the far-reaching benefits new Oakite cleaning methods will bring to tomorrow's metal-working operations?**

We live in fast-moving times.

Four short decades ago, when industry first employed Oakite materials to improve upon old-fashioned soda-kettle washing practices, it little realized the startling progress that industrial cleaning was destined to achieve. Nor could it conceive how Oakite methods and service would contribute to the unerring precision, efficiency, and amazing speed required in today's streamlined manufacturing operations.

The record speaks for itself. Today, industry knows it can depend upon modern Oakite materials, methods and service to keep production volume at high levels . . . to keep unit costs low . . . to obtain uniform, durable, attractive product finishes that promote sales.

But production cleaning and its related techniques cannot be permitted to rest on past or present accomplishment. So the Oakite Engineering, Technical and Chemical Research Staffs are even today creating, testing and perfecting tomorrow's materials and methods that will contribute greatly in helping the metal-working industry reduce manufacturing costs in the years ahead. Oakite Products, Inc., 21A Thames Street, New York 6, N. Y.

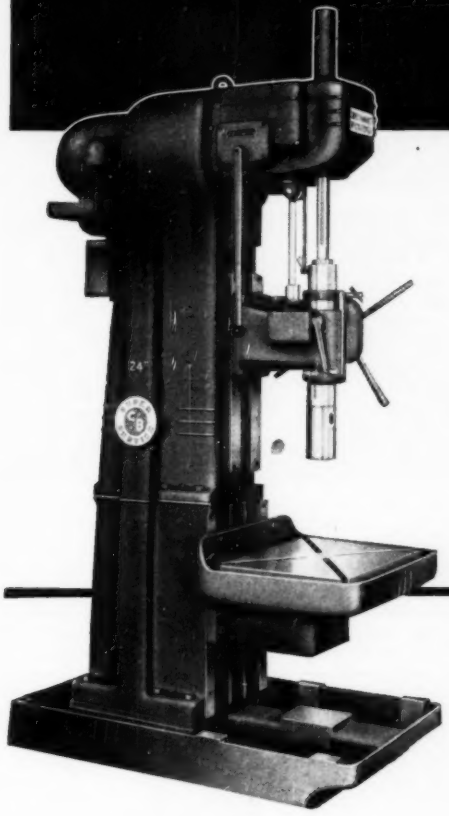
*Oakite Technical Service Representatives Are Located in All Principal Cities of the United States and Canada*

**OAKITE**

INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE

They have the SPEED and ENDURANCE for

# *Automotive Production*

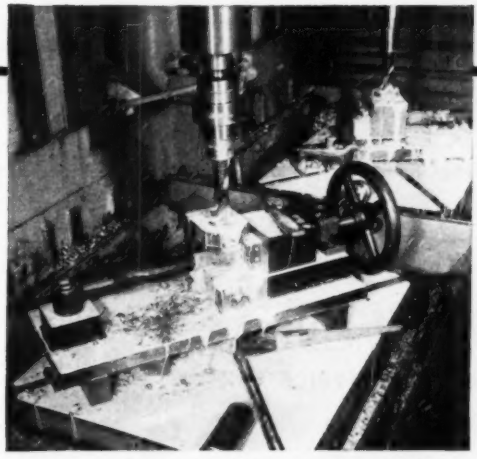


Among the factors which permit long and severe working performance of Bickford Super Service High Production Upright Drills are the direct drive motors, positive type clutch, sturdy gearing, integral keying of all spline shafts, and complete protective enclosure of all mechanism.

Speeds and feeds are easily obtained by the operator. Control levers are at operator's finger tips, and bring rapid and easy operational control.

The close-up shows a Cincinnati Bickford Super Service Upright Drill at work in the automotive industry where production is a must.

Write for Booklet U-27—a complete description of the construction features and capacities of Cincinnati Bickford Super Service Single and Multiple Upright Drills.



Courtesy—The Kaiser-Frazer Willow Run Plant.

THE CINCINNATI BICKFORD TOOL CO.

RADIAL AND UPRIGHT DRILLING MACHINES

SUPER SERVICE

Radials 7½" dia. col., 2½' arm, to 36" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines.

*Equal Efficiency of Every Unit Makes the Balanced Machine*

**THE CINCINNATI BICKFORD TOOL CO.** Cincinnati 9, Ohio U.S.A.

• 7200 stainless steel stampings per hour—

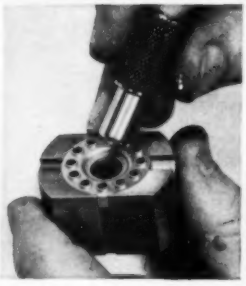
• tolerances held within 0.002" —

...using

# DANLY

## STANDARD PRECISION

# DIE SET



**Sustained operating precision of die set reduces die wear...produces 200,000 stampings per grind**

Inherent accuracy in Danly Die Sets permits taking full advantage of the die maker's precision under actual press operating conditions. As a result, close tolerances may be held and tool life is substantially increased.

In the stamping operation shown, stainless steel parts for electrical instruments are pierced, formed and blanked in an intricate progressive die. Tolerances are extremely close, and finished parts must pass rigid gage inspection.

Stampings are produced at a rate of 120 per minute. At this high speed, a tolerance of 0.002 in. is held on inside and outside diameters and the distance between the bent arms. Danly Die Set accuracy is a major factor in maintaining punch-and-die relation, resulting in production of 200,000 parts between grinds.

**DANLY ENGINEERING SERVICE**—Use Danly Die Sets to insure the same close precision, high production and long die life on all of your press work. Consult our Engineering Dept. for helpful recommendations on die sets—large or small, standard or special—for *any type* of press operation. (No obligation.)

**DANLY NATION-WIDE ★ASSEMBLY SERVICE**

**Danly offices in 10 key cities give immediate attention to your orders. Assembly plants (marked with stars) stock interchangeable parts for quick delivery of any standard die set to your specifications.**

★ **Chicago 50,** 2100 S. 52nd Ave.
★ **Cleveland 14,** 1550 E. 33rd St.
★ **Dayton 2,** 990 E. Monument Ave.
★ **Detroit 16,** 1549 Temple Ave.
★ **Grand Rapids,** 113 Michigan St., N. W.
★ **Long Island City 1,** 47-28 37th St.
★ **Los Angeles 54,** Ducommun Metals & Supply Co. 4890 S. Alameda
● **Milwaukee 2,** 111 E. Wisconsin Ave.
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**get this *free* bulletin**

Illustrates how Danly Service on special die sets can save you time and money.

**DANLY**

**DANLY MACHINE SPECIALTIES, INC.**

**2100 SOUTH 52ND AVENUE, CHICAGO 50, ILLINOIS**

PRECISION DIE SETS...STANDARD AND SPECIAL | MECHANICAL PRESSES AND PRESS EQUIPMENT

# SPOT NEWS OF METALWORKING

**An electric furnace** designed to give temperatures as high as 4000 to 5000 deg. F. is being built by a Michigan company. It is to be used for special government research work. Ultra high temperature furnaces now are being employed to get better alloys for gas turbine blades.

**A fibre-glass washing machine tub** has been developed by one appliance manufacturer. The tub is made in a metal die, can be painted any desired color (or a color pigment can be put into the plastic), cannot be dented, can be made at a lower cost than a metal tub.

**Torque converter for 1950 Chevrolet will not be in production** even on a pilot-line basis until late summer of this year at Saginaw, Mich., plant of Detroit Transmission Division of General Motors. Detroit Transmission has completed its one-millionth hydra-matic transmission. Some 414,000 have been made in the last calendar year.

**Plymouth and Dodge will each introduce an economy line** of cars stripped of all non-essential accessories and on wheelbases seven to eight inches shorter than the regular lines.

**First of two 2500-hp. gas-turbine-powered electric-drive locomotives** on order for British Railways (Western Region) will be delivered next July by Brown-Boveri, Ltd., Switzerland. Unit weighs 113 tons and has top speed of 90 m.p.hr. Second is being built by Great Western Railway in its own shops, the propulsion machinery to be supplied by Metropolitan-Vickers.

**General Motors' employees** will lose some or all of the three-cent cost-of-living increase they got last September when the January 15 price index figures come out in February. By June, the escalator clause may wipe out some of the 11-cent rise granted last June in third-round negotiations.

**Exports of metalworking machinery, including machine tools,** are estimated at $152 million for 1948. That represents a sharp drop from $198 million the previous year. There is no way of telling which exports are ECA and which are not. ECA reports details of who bought what from whom, but there is a four-months' lag in the figures.

**In bargaining on welfare plans, CIO has laid down three principles** to guide its negotiators: (1) get a definite amount contributed by the employer; (2) have the money put into a trust fund, so it cannot be used for any purpose other than social security benefits; and (3) obtain an equal voice in developing and operating the program.

**British machine tool production** has been running at an annual rate of $120 million, not too far off from its peak war output of $136 million in 1942. Exports to Soviet Russia in the first ten months of 1948 amounted to only $244,000.

**Draft deferment of apprentices** under 24½ years of age, who have had six months of training under federal or state standards, has been recommended by Federal Committee on Apprenticeship, policy-recommending body of Bureau of Apprenticeship of Labor Department in Washington.

**Company stockholders who work in your plant have a right to vote** in a union bargaining election if they are not directors and do not hold executive or supervisory positions, according to NLRB in case of Alderwood Products Co., Arlington, Wash.

**Foreign notes: Argentina has ordered work stopped** on $8 million of diesel railroad engines by General Electric because of dollar shortages; Dutch are to build a factory at Harderwyk, the Netherlands, to combine output of four existing Dutch small diesel engine plants; India's second locomotive factory will begin production in 1950 at Mihijam, 150 miles northwest of Calcutta, representing investment of $25 millions.

# Gaging Metalworking

**January was a very active** month for the country's metalworking industries. Production is believed to have held up well compared with December. And incoming orders in various lines promised a continuation of a high level of activities the next few months.

▸ There are soft spots, to be sure, in both machinery and consumer-goods products. A buyer's market is back in almost all metalworking segments, even in portions of the automobile industry. But the inducement of lower prices for consumer goods, sustained purchasing power by most people and the promise of a "shot in the arm" from ECA in capital goods lead to the conclusion that 1949 will be a good metalworking year.

### Surpluses Are Troublesome

Though this year promises to be as good as last year in dollar volume of machine tool business, or perhaps better, the troublesome question of surpluses has not yet been eliminated. It sometimes assumes the form of disposals of privately-held machines rather than government-owned machines. Examples: Ford Instrument Co. had a public auction sale of $750,000 of machines on Feb. 2; and Narragansett Machine Co., Pawtucket, R.I., sold at auction $2 million of real estate and machinery, including machine tools, on Feb. 8.

### ECA to Help Machine Tools

Before this year is out, it is a good bet that around $60 million of U.S. machine tools will have been sold to ECA countries. It is reported that about $75 million of the ECA funds yet to be authorized for fiscal 1950 (beginning next July 1) will go for American machine tools. On the basis of ECA-originated business alone, it appears that the percentage of machine tools going abroad will rise this year to 20% or more of the total. The past year the ratio averaged some 14% or less.

### Machine Tool Exports Stronger

Machine tool buying looked up in January, thanks to an improvement in both domestic and foreign orders. Purchases in this country were well distributed among various user industries. In a few cases, defense business was a sizable portion of total bookings.

▸ In the foreign field, ECA-financed sales began coming through in more liberal volume. Export-Import Bank loans also helped to finance some new machine tool orders. Italy and Austria have both been recent sources of business for U.S. machine tool builders. Some companies have been beneficiaries of purchases by Renault, the French government-sponsored automobile factory. The money came out of ECA.

### Machine Tool Orders Expand

Latest figures on the machine tool industry are on the encouraging side. New orders in December stood at 76.7 on the National Machine Tool Builders' Association index (average shipments 1945-1947 equal 100). This compares with 72.2 in November.

▸ Foreign orders in December comprised 16.2% of total new orders, down from 18.1% in November. Exports, however, were considerably better than during most of last year, when they were in the 11-13% range for months.

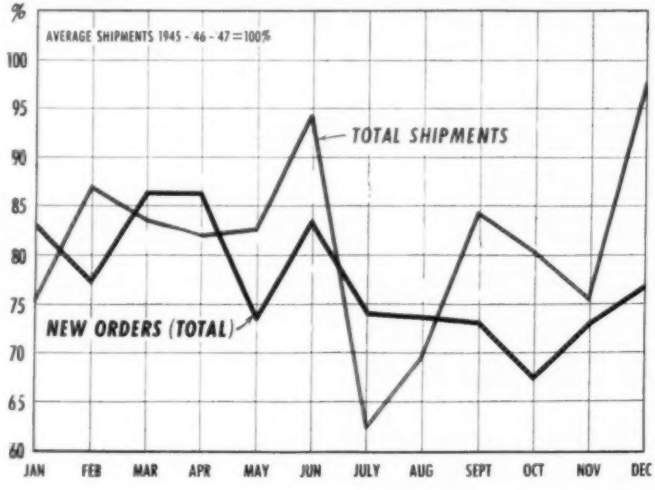
▸ Shipments spurted tremendously in the final month of 1948, rising sharply to 96.9 from 76.2 during November.

### Pressure Eases in Steel

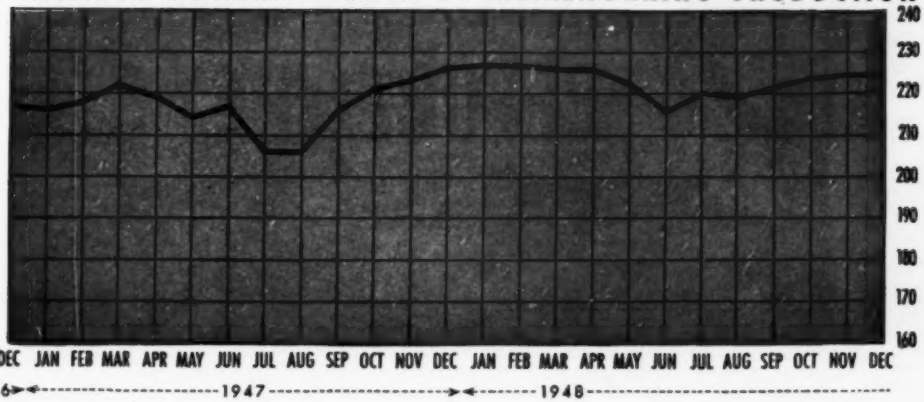
While there still is not enough steel to go round, the steel situation shows the first real signs of improvement postwar. The gray market is beginning to crumble; and premium prices have broken badly. Buyers are far less willing than they were even a few months ago to pay exorbitant prices to get steel tonnage. Conversion deals continue to be made, but here also there is reluctance to agree to prices which "stick" the buyer. One large steel company reports heavy cancellations from both the capital goods and consumer goods fields. As one mill executive put it, "the pressure is definitely off."

▸ It would be foolish to interpret events as meaning that steel is going begging in the next few months. Full production is likely up through

## Machine Tool Orders and Shipments Rise



## American Machinist INDEX OF METALWORKING PRODUCTION




| INDEX | COMPONENTS | | | | |
|---|---|---|---|---|---|
| | MACHINERY | ELECTRICAL MFG. | AUTOS, TRUCKS | TRANS-PORTATION EQUIP. | OTHER METAL-WORKING |
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| Nov. 1948..... 224 | 250 | 236 | 223 | 311 | 159 |
| Dec. 1947..... 226 | 247 | 245 | 235 | 293 | 154 |

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1 Index figures are a percentage of 1939, which equals 100.

June at least. But there may be some easing of operations later in the year.

### Appliance Outlook Uncertain

Conditions in the household appliance field reflect the fact that manufacturers are rapidly catching up on unfilled orders, if they are not already completely caught up. The market seems strongest in dishwashing units, electric refrigerators and ranges. One prominent company currently is producing 12,000 ranges, 5,000 water heaters and 2,000 dishwashers a week. It plans to keep up this terrific pace at least until the middle of the year.

▶ It is apparent, though, that present-day appliance output is so heavy that considerable stocking of distributors and dealers will be accomplished as the months roll by. That means that the payoff for 1949 will be determined by the volume of retail sales in the last half of the year.

### Aluminum Outlook Discouraging

Aluminum situation is as bad as ever, with slight hope of improvement the next few months. Output of primary aluminum last year topped that in 1947 by almost 1 million lb. despite the power shortage. Total production in 1948 was 1.24 billion lb.

▶ The fact is that primary aluminum showed an unexpected pick-up during December, but sheet and strip shipments fell off.

▶ The copper, lead and zinc situation remains unchanged despite the announcement of the Munitions Board that stockpiling will be accelerated without regard to its effect on the civilian supply.

▶ Unfavorable weather is likely to cut back the output of copper. Demand is sufficient to absorb all offerings. A decline in consumption of some items, such as brass, has not affected much the overall requirements for copper.

▶ Offerings of lead are on the liberal side, with some sellers willing to discuss forward business. Most observers agree that lead consumption is dropping off a bit.

### Washing Machine Business Off

The situation is worst in the washing machine and stove markets, where production has been curtailed drastically. Two factors are to blame: 1) tighter credit regulations by Washington, and 2) consumer resistance to present prices. A third factor might well be chalked up: greatly enlarged production the past year as against prewar years and the satisfying of pent-up demand.

### Vacuum Cleaner Sales Drop

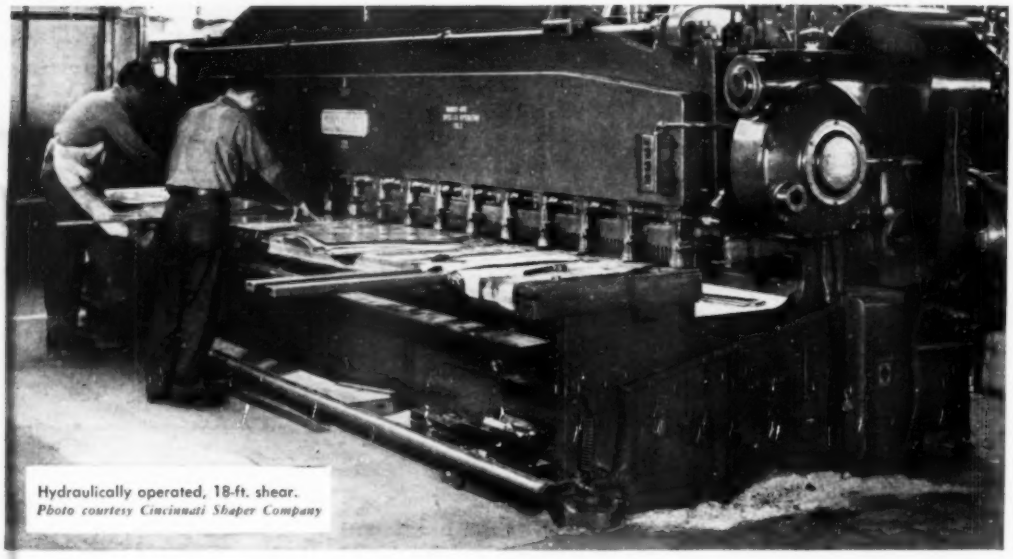
Typical of what is going on, or promises to happen, in household appliances is the situation in household vacuum cleaners. Factory sales in December were 274,180 units, a gain of 7.5% over November, but a decline of 26.5% from December, 1947. It was in December a year ago that the industry reached its all-time high.

▶ Sales for 1948 aggregated 3,361,149 units, compared with 3,800,687 units the previous year, a drop of 11.6%. Total production in the three post-war years is 9,451,277 units, a figure which it took the industry nine years to achieve prewar.

### Gear Business Rises

The volume of business done by the gearing industry went up during December by 5.4% as against November, according to the new index of the American Gear Manufacturers' Association. The December figure was 325.9, with 1935-1939 taken as 100. January also is believed to have been a good month for the gear people, though official figures are not yet available.

# STOP rust and sludge BEFORE THEY START



Hydraulically operated, 18-ft. shear.
*Photo courtesy Cincinnati Shaper Company*

## Keep hydraulic systems clean by using Texaco Regal Oils (R&O)

YOU by-pass a lot of trouble and expense when you use *Texaco Regal Oils (R & O)* to assure smooth, trouble-free operation in your hydraulic systems. These turbine-grade oils are inhibited against rust and oxidation, and have been specially processed to prevent foaming.

The rust inhibitor in *Texaco Regal Oils (R & O)* "plates out" on the metal it contacts, so that air and moisture cannot reach and rust it. And *Texaco Regal Oils (R & O)* are especially inhibited to thoroughly resist oxidation — the main cause of sludge. Thus, the main causes of stoppages are avoided before they get a start.

*Texaco Regal Oils (R & O)* give longer service than uninhibited oils . . . and you can get them in all needed viscosities. *Texaco Regal Oils (R & O)* are recommended or approved by leading hydraulic equipment manufacturers, many of whom ship their units filled with these fine oils.

A Texaco Lubrication Engineer will gladly help you get greater efficiency and economy in the operation of your hydraulic equipment. Just call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

## TEXACO Regal Oils (R&O)

### FOR ALL HYDRAULIC UNITS

Tune in . . . TEXACO STAR THEATRE presents MILTON BERLE every Wednesday night. METROPOLITAN OPERA broadcasts every Saturday afternoon.

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

# Underdepreciation Is a Menace

Metalworking companies are setting aside alarmingly small reserves for depreciation of their plant equipment.

Underdepreciation is the word for it. Instead of figuring replacement allowances on the basis of present-day costs, they seem satisfied to put in reserve only an amount figured on the original cost.

Such figuring results in inadequate reserves for purchase of new equipment at today's prices.

The Machinery and Allied Products Institute reports that only nine percent of the companies participating in a recent survey made any provision for underdepreciation in their 1947 annual statements. Moreover, only 16 percent are doing so in their 1948 statements.

It is not hard to explain why this practice persists. For tax purposes, the federal government sticks to the archaic and harmful policy of limiting write-offs roughly to five percent of the original cost. That is all, then, that the managements take.

Underdepreciation leads to two undesirable and detrimental results. It falsifies, in a sense, the profits which a company seemingly makes. It enables management to show up better financially than the situation warrants.

Beyond that, underdepreciation fails to provide adequate funds to maintain plant equipment at a proper level of efficiency.

Not enough money is earmarked to replace machinery as fast as it should be. Plant machinery thus grows more aged and production becomes more expensive.

Dangers inherent in underdepreciation were pointed out vividly by an impressive array of witnesses who testified recently before the Flanders (U.S. Senate) subcommittee on profits.

Sumner H. Slichter, Harvard professor and economist, lashed out at the practice of most corporations in counting "the rise in the cost of replacing plant and equipment as profits." He continued, "Only after management has set aside enough of current income to maintain the productive capacity of the enterprise, does it have funds which may properly be regarded as available for dividends, higher wages, or lower prices."

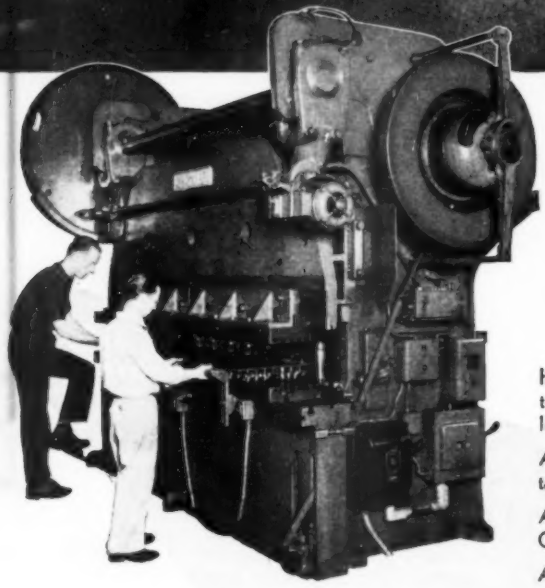
E. M. Voorhees, chairman of U. S. Steel's finance committee, was even more direct in his remarks than Professor Slichter. "It is a simple truth," he said, "that to buy similar tools of production takes many more dollars today than formerly; to count as profits, rather than as cost, the added sums required merely to sustain production is to retreat from reality into self-deception. Calling a cost a profit does not make it so."

It is clear, then, that underdepreciation as currently practiced will lead industry into further postponement of vital machinery replacements. Today's set-asides are not big enough to carry out replacement programs which will keep the nation's metalworking plants in fit physical shape, ready to do their assigned tasks economically and efficiently.

It is time to outlaw underdepreciation as a menace. For it should be substituted a realistic replacement policy based on today's costs.

Burnham Finney

EDITOR



● *Courtesy* . . . KIRK & BLUM, Cincinnati, Ohio

# 72 HOLES

## where they belong

Holes must line up—or assembly bogs down. Seventy-two holes are punched in this 10-gauge sheet, accurately located by Cincinnati standard micrometer gauges.

Accurate hole spacing—accurate hole position—are maintained, and assembly is smooth and trouble free.

As production machines, or as machines for jobbing work, Cincinnati Press Brakes are highly profitable.

As a press, they offer high production with low investment. As a Press Brake, their low set-up costs, quick change-overs and versatility bring profits.

Write for Catalog B-2A for complete description of the extensive line of Cincinnati Press Brakes, with many illustrations of the diversified uses of these machines.

**THE CINCINNATI SHAPER CO.**

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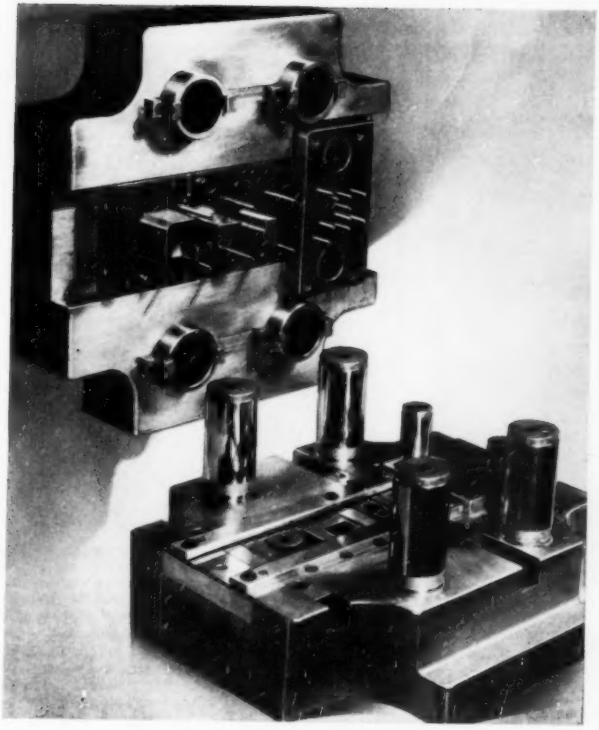


**Lamination die** used by Shick Incorporated to produce laminations for electric shavers. First station punches ten small holes, second station is not used, third station blanks rotor, fourth station trims scrap, and fifth station blanks the stator. Rotor and stator laminations are shown above. Life expectancy of the die is 375 million hits.

# CARBIDE DIES SET PRODUCTION RECORDS

**A million hits per grind is not uncommon with carbide die sets, and life expectancy is usually 20 to 60 times that of steel dies**

BY A. EARLE GLEN, CARBOLOY CO., INC.

CARBIDE DIES for sheet-metal press work are definitely out of the experimental category, judging from a recent field survey. Reports obtained on comparative carbide-die performance cover products ranging from bottle and screw caps to electric razor and clock parts.

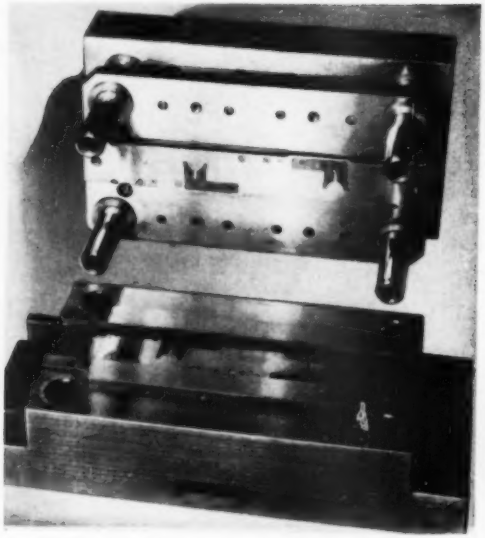
No major difficulties were encountered in application, but experience indicates that for maximum economy of performance a number of deviations are desirable from customary practice when using steel dies. These include:

1. Average initial cost of a carbide die is roughly three to five times that of a comparable steel die, although it may run ten times that of a steel die. In contrast, life of a carbide die appears to be from 20 to 60 times that of a steel die. Cost of carbide dies could be materially reduced if some safeguards now necessary in construction (due to press design limitations) could be eliminated or at least reduced.

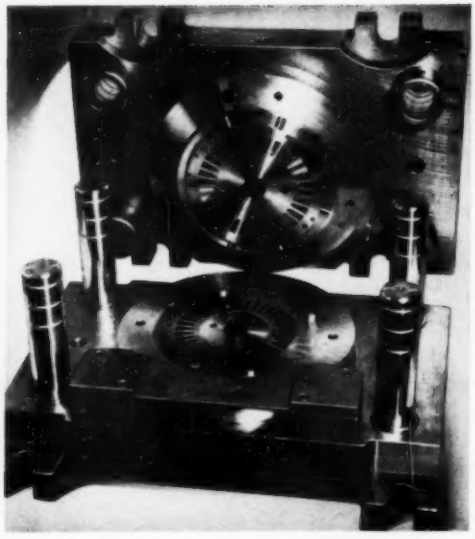
2. Life is best at higher ram velocities than is normal for steel punches and dies. Limiting factor on speed is transferred from die assembly to machine when carbide dies are used, and is usually controlled by maximum feed speed.

3. Long life of carbide dies make it necessary to provide for periodic inspection of press equipment to prevent breakdowns while the die is still running and in good condition.

4. For most economical service, the average die should be run until a regrind of from 0.004 to 0.006 in. is required, even though longer life between grinds is possible. This would compare with an average of 0.010 in. for steel dies. For example, in stamping motor laminations, the old criterion of changing dies when the burr



**Progressive, four-station** carbide die stamps out electric clock motor laminations at Telechron Inc. Press operates at 340 strokes per min. Average of two million hits per sharpening compares with prior rate of 100,000 for the steel die originally used on the same job



**Electric motor stator** laminations are punched from motor grade silicon steel on this carbide die set which averages 1,200,000 hits per sharpening and can be reground 250 times. Stock is 0.017 to 0.025 in. thick. Toledo 50-ton press is used with automatic slide feed

height becomes objectionable does not hold. This is because carbide dies do not round over, and excessive wear may result in chipping at the edges.

5. Wear on carbide punches, in general, ranges approximately 50% above that for the mating dies. Thus, in grinding, to sharpen a punch may require removal of 0.006 in. as compared with 0.004 in. for the die.

6. In stamping parts with continuous feed, care should be taken to prevent loading up of slugs. Usually, with steel dies, this is not a problem, as the die is removed for reconditioning before the slugs load up.

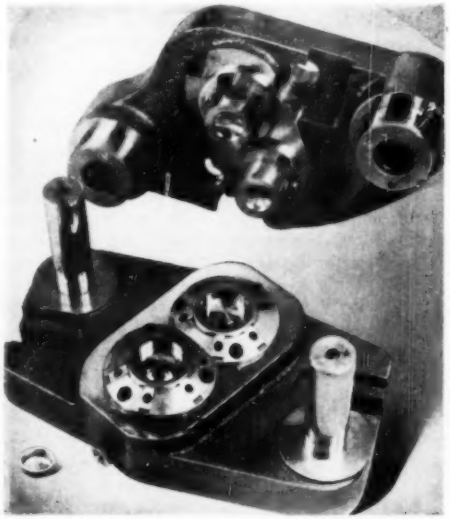
7. In general, where carbide dies are to be used, it is preferable to avoid sharp corners, in shapes and forms, substituting small radii.

8. When punches are replaced before the die, they should be made slightly larger than originally, to compensate for the back taper in the reground die. This usually happens once in the life of the die, because punch life averages 50% of die life when both are carbide.

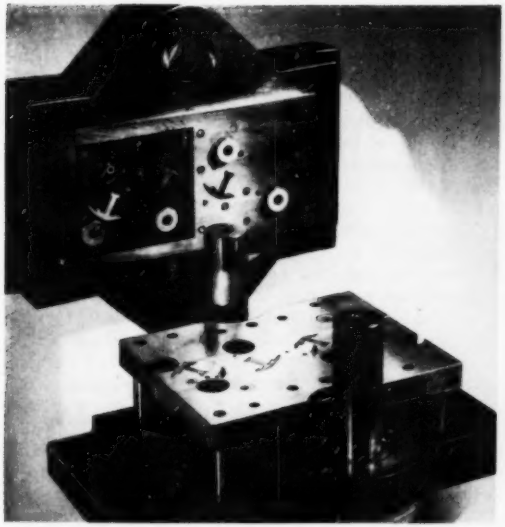
A number of case histories on carbide sheet-metal dies are shown in accompanying illustrations. All of these were produced by Lincoln Park Industries, using Carboloy sheet-metal die grades of cemented carbide.

A progressive die is used by Schick Incorporated, to produce rotor and stator laminations for electric shavers. The laminations are cut from 0.014-in. silicon steel strip in four stations of the five-station die.

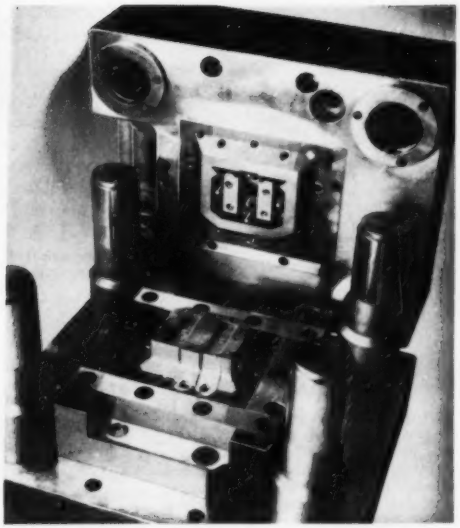
The die is used in a 25-ton high-speed Henry & Wright press, and the original die is still running



**Bottle and screw** caps are blanked and crowned two at a time in this carbide die used by Armstrong Cork. Steel dies previously used for this job required regrinding twice a week; carbide die seldom needs sharpening. Material is 0.012-in. tin-plated steel sheet



**Motor grade silicon** steel 0.023 in. thick is punched in this transfer carbide die used by Minneapolis-Honeywell for small motor laminations. Close tolerances are held satisfactorily with this die; with steel dies accuracy could be held only on extremely short runs



**Carbide webs,** only 0.027 in. wide, are used in this punch assembly for laminations at General Electric Co.'s West Lynn plant. Life between grinds is 20 times that of steel dies. Use of small radii instead of sharp corners increases die life 50%

after one year. It is sharpened by grinding 0.004 in. off the top surface of the die and 0.006 in. off the punch cutting faces after each 3,000,000 hits. This gives the die set a life expectancy of roughly 125 grinds—or some 375,000,000 hits—if no other cause for scrapping the die develops. In comparison, on the same job, steel dies costing about one-third as much as the carbide dies produce an average of 100,000 hits per sharpening and approximately 0.010 in. is removed per grind.

A four-station progressive die for stamping small motor laminations is used in a No. 645 Bliss press by Telechron Inc. This carbide die and punch set produces stator laminations for electric clocks. Two pieces are perforated and blanked at the same time in the four stations. When performance was checked, it had performed eleven million (11,000,000) hits on four grinds. This is higher than the average for best economy, which is about two million hits per grind. The reason for this discrepancy is that between two of the grinds, the die set was allowed to produce 4,000,000 hits. However, too much stock had to be removed in grinding to warrant the additional production. The economical average of two million hits compares with 100,000 for a steel die. Material is 0.031-in. mild silicon steel.

**Unusual carbide die** assembly used by Armstrong Cork to set aluminum foil in bottle caps. Average production per grind is six weeks, compared with 8 hr. for steel punch and die renewal. Press operates at 210 strokes per min. Material is highly abrasive

An interesting feature of this die set is the thin tongue of carbide projecting into the lamination. It was debated, when the die was designed, whether this tongue would stand up, since it has no side support. However, at one time during the run the feeding mechanism jammed and the material fed improperly through the die. Despite the severe unbalanced load on the tongue, no damage was caused. This die set operates at 340 strokes per min.

A carbide die set is used at one of the plants of an electrical manu-

Part of gate from feeder mechanism of press equipped with $12,000 carbide die dropped off while press was running. Shown here is the result of what happened when gate dropped into die. Cost of repairs amounted to only $278

facturer for stamping stator laminations for small electric motors. Nine similar dies are currently used on this job. Material is a motor grade of silicon steel ranging from 0.017 to 0.025 in. thick. The die is used on a 50-ton inclined Toledo press equipped with an automatic slide feed for the blanks. Average performance figures show an economical run of 1,200,000 hits per sharpening, as against 60,000 hits for a steel die. The die is 1¼ in. high, giving a die life expectancy of some 250 grinds —since it would probably be inadvisable to grind it down beyond 1 in. thick.

The first carbide die tried out on this job had floating punches and segmented guiding stripper, designed for use on a short-stroke press. Experience indicated that the cost involved in this "to-be-safe" construction was not necessary. A second die was then obtained with conventional low-cost open construction. While satisfactory in operation, experience with the second die led to a compromise in design to strengthen the die as added insurance against failure without too great an increase in cost. Seven such dies are now in operation and their cost is less than three times that of comparable steel dies.

The history on two more types of lamination die sets also are of interest. Used at the West Lynn plant of General Electric Co. one of these was described in detail in *A.M.*, Aug. 14, 1947. Used to produce potential laminations, the punch has extremely thin webs at two points. In designing the die it was thought that this might be a source of die failure, and the webs (only 0.027 in. wide) were made separately and inserted as replaceable units. Operation has revealed that this precaution was unnecessary.

Experience with this die has demonstrated the advantage of avoiding sharp corners where possible. With sharp corners, comparative die life between grinds (440,000 hits on 0.025-in. high-silicon steel for the carbide die set) was about 20 times the average for steel dies. Since sharp corners have been changed to small radii, die life has gone up to a point where it appears that the carbide die set will produce 750,000 hits between grinds.

### High Accuracy Obtained

A carbide die set used by Minneapolis-Honeywell Regulator Co. was also described in *A.M.*, Aug. 14, 1947. This transfer die licked a tough problem and made it possible to improve motor design. With steel dies, it was found impossible, except on extremely short runs, to hold the accuracies required on individual parts, which nest together and must fit to 0.002 in. when assembled in a ring. Actual production figures are not available in this case, but the die has been reground only once since it has been in operation. Material stamped is 0.023-in. motor grade silicon steel sheet.

Bottle and screw caps are blanked and crowned at one Armstrong Cork Co. plant with a carbide die set which has been in operation for so many months—with regrinding only rarely—that complete count has been lost on the number of parts turned out. In comparison, steel dies had to be reground twice a week. Two caps are blanked and drawn at each press stroke, the material being 0.012-in. tin-plated steel sheet.

A different type of carbide sheet-metal die operation performed at Armstrong Cork, is to set aluminum foil in bottle caps. Spot punches, dies, and guiding strippers are all made of Carboloy cemented carbide. Sets operate at 210 strokes per min. and have run three months without regrinding. The average of six weeks production per grind compares with less than 8-hr. (twice daily) renewal of steel punch and die sets. This application, one of the earliest uses of carbide sheet-metal dies, has been so successful, despite the very abrasive material handled, that virtually every cap manufacturer is now using or installing carbide equipment for this purpose.

### Press Maintenance Needed

The question has been frequently asked as to what happens to a carbide die set if something gets jammed between die and punches. An answer to this is shown in one of the accompanying illustrations. It shows part of a feeder mechanism gate of a press equipped with a $12,000 carbide die. The die kept on turning out pieces and no attention was given to the press. Finally the feeding mechanism fell apart and the gate dropped into the die. When checked, it was found that no major damage had been caused to the die and the entire repair bill after this accident was only $278. This serves to emphasize the importance of periodically checking press equipment, since carbide die sets will usually stand up much longer before needing service than any other equipment on the press.

## Still Tapco

A SUPERANNUATED NEGRO, asked how he'd lived so long, said, "When de inevitable comes along, ah just cooperates wid it." Thompson Products, moving its headquarters from the old "Main" plant to the war-built Tapco plant, has just decided to emulate that Negro. Company executives decided to rename Tapco as the "Main" plant (it is larger than the old one), got as far as painting the name on trucks. But the repercussions indicated that it would be like trying to relocate Gibraltar—so Tapco it still is.

# LATHE FIXTURE BORES TO EXCEPTIONAL TOLERANCES

**How can your standard machine tools bore holes within 0.00001 to 0.00005 in.? . . . Here's the answer**

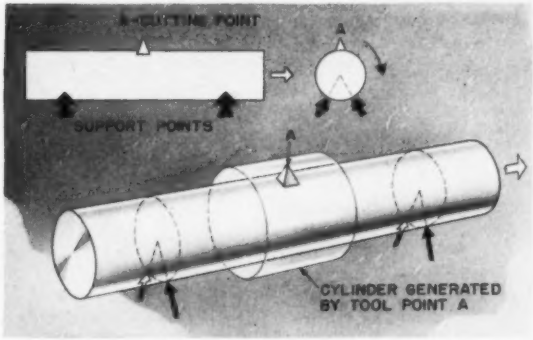
R. W. DAYTON and C. M. ALLEN
Battelle Memorial Institute, Columbus, Ohio

TEST BEARINGS must be accurate to a few hundred-thousandths. But bores produced on good lathes in our shop are not round and straight to better than a few ten-thousandths of an inch. To solve this difficulty we devised a boring technique in which accuracy is independent of the lathe. With this method, 1¼-in.-dia. test bearings are being made as a routine thing, to an accuracy of 0.00001 to 0.00002 in., and 4-in. bearings have been bored straight and round within 0.00003 to 0.00005 in. on standard machine-tool equipment.

The principle of the method is shown above. If *A* is the cutting tool and the workpiece is placed between the pairs of supporting points, and is rigidly fastened to the base that holds the points, an accurate surface may be bored. When the bar is rotated and moved axially while resting on the points, the tool describes an accurate helix. By the proper choice of feed and of tool radius, the cut is made so the bored surface is, for all practical purposes, a true cylinder.

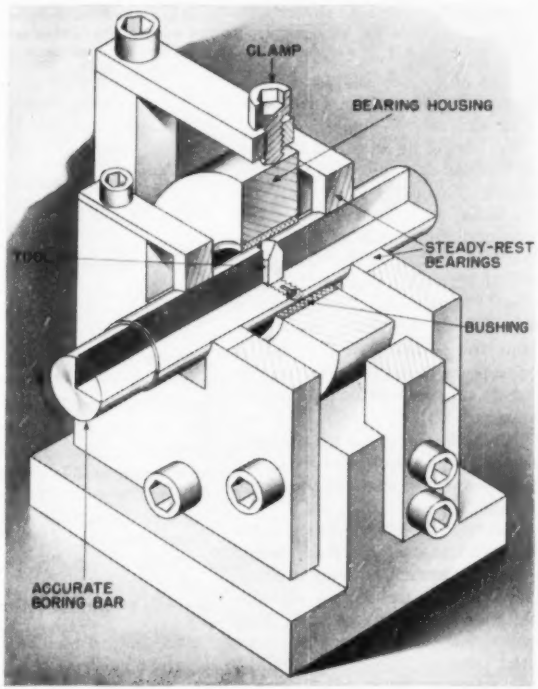
One modification is required to make the idea practical. The supports for the bar must have sufficient area that wear does not become a problem. Yet they must be small enough so thick films of lubricant are not built up. In all practical applications, the re-

## THEORY OF PRECISION BORING TECHNIQUE



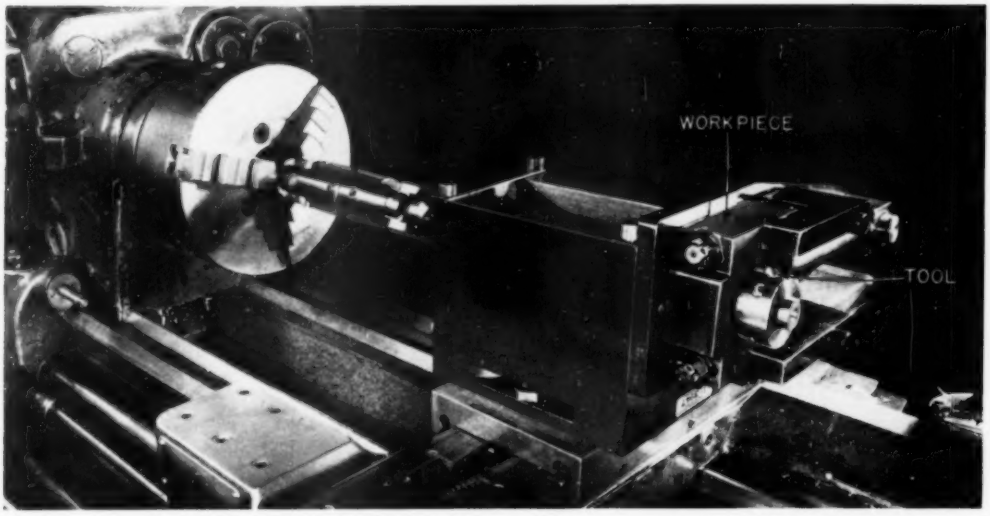

**Principle** of the technique is to support an accurate cylindrical bar at four points and to constrain its motion to rotation and translation about its own axis. Every point *A* attached to the bar is the locus of cylinder. In the absence of wear, accuracy of the cylinder depends only upon the accuracy of the bar

## JIG THAT PUTS THE THEORY INTO PRACTICE




**Practice** calls for a boring bar supported on its two ends in steady-rest bearings. Front bearing on each end can be seen in the sketch; the back one is hidden by the bar. Pressure to overcome the cutting load and to keep the bar pressed down firmly against the lower supports is applied through two points of contact on top of the bar. The workpiece is clamped in a rigid housing between the bar supports

## THIS JIG CLAMPS THE WORK OUTSIDE THE TOOL SUPPORTS




**Outside mounting of workpiece** is often more convenient and has no harmful effect on the results. An added advantage is that a boring head can be put on the end of the bar to feed the tool into the work by small, known increments

quirements are met by small pads, faced with silver solder.

The boring jig shown is the way the method is applied in practice. The jig is attached to the carriage of a lathe, with the axis of the bar coincident with that of the lathe. The bar is turned by the lathe spindle through a pair of universal joints. Thus, while the required motions are obtained from the lathe, the accuracy of the method depends on that of the boring bar and its support, not on that of the lathe.

The universal joints for connecting the bar to the spindle are clearly shown in the view of the alternate jig, above.

Another useful application for the technique is to obtain nearly perfect alignment of bearing bores. The setup for the testing-machine bed shows how this is done. Hole sizes in each bearing may be somewhat different, depending upon the tool settings. In the testing machine built on this bed, extremely accurate alignment, and roundness and straightness of the bearing bores were essential. Inaccuracies of the finished bearings were less than .00005 in.

In the table below, measurements are given for a typical test bearing, bored in a jig of the type first shown.

BEARING DIAMETER IN INCHES

| | *Vertical Axis* | *Horizontal Axis* |
|---|---|---|
| Top | 1.23910 | 1.23911 |
| Middle | 1.23911 | 1.23911 |
| Bottom | 1.23912 | 1.23912 |

These measurements were made with a Pratt & Whitney Electrolimit Universal Internal Comparator, on which the divisions were 0.00002 in. Five microinches variation can readily be detected on this instrument. The roughness of the bearing surface was about 12 to 15 microinches, as shown by a Profilometer.

### *Details of Construction*

The boring bars are made of a medium-hard steel, approximately 42 Rockwell C. A harder steel would be preferable from the standpoint of wear, but since it is essential that the bar be nearly strain-free so that it does not warp over long periods of time, a relatively high draw temperature is required. In practice, the bar is drawn at 800-1000 F. for 24 hr., and cooled slowly to avoid introducing thermal stress. Harder, strain-free materials, such as tungsten carbide, would probably be excellent for the purpose, but the wear resistance of the steel used has been good enough to meet the requirements of the study.

The bar is then ground, and finally, ring lapped. The lapping operation is critical, because the accuracy of the work produced in the jigs depends entirely on the accuracy of the bar. The ring lapping is carried on with successively finer abrasives, ending with small amounts of rouge or levigated alumina in kerosene. The bar is considered satisfactory when its errors are less than 5 microinches.

The jigs are made of mild steel or cast iron, thoroughly stress relieved. The major requirement of the design is that the rigidity, between the support pads and the part being bored should be extremely high. The support pads are rough bored, then faced with silver solder and bored to finish size. Very accurate boring is not essential, and wearing-in soon provides

accurate, rigid seating. The pressure pads are made in the same way, and bored at the same time. During the boring of these pads, shims are introduced between the flexible support and the jig, and firm backing is provided for the pad. After boring, the shims and backing are removed, and the flexible support then provides the required pressure to hold the bar against the lower pads.

The jig is mounted on a suitable machine tool, with the axis of the bar coincident with that of the machine tool. The feed of the machine is used to move the jig longitudinally at the proper rate. The bar is driven by the machine tool spindle, customarily through a pair of universal joints which have been worked over so that they do not bind and exert radial forces on the boring bar.

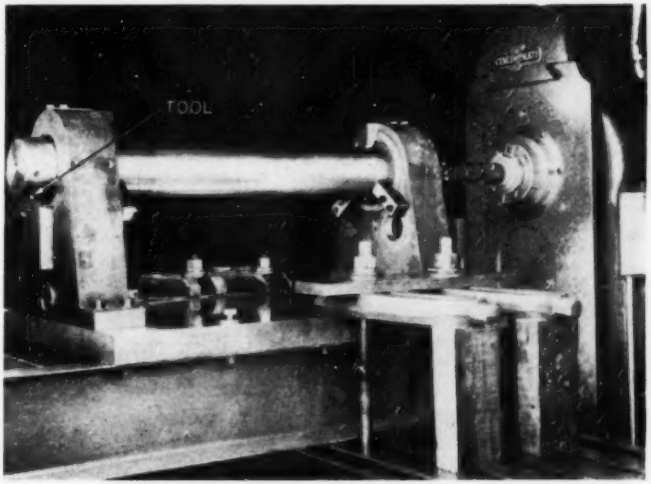
Cutting speeds are low, under 100 rpm., to avoid heating and hydrodynamic effects between the pads and the bar. The pads are lubricated with a small amount of a thin lubricating oil. Great care must be taken to keep chips and dirt from the pads.

The depth of cut is made very small to avoid forces which might lift the bar. The usual depth of cut is about 0.001 in. Carbide tools have been used most successfully. The wear of high-speed steel tools, small though it is, has been troublesome, and diamond tools have not proved rugged enough for use in our toolroom. A hard grade of carbide is preferable.

The bar should be measured from time to time during its working life, and relapped when wear is apparent.

The technique described in this paper has proved extremely valuable in bearing research at Battelle. This description has been given because it is believed that others, confronted with the problem of making more accurately bored holes than can be prepared by conventional methods, may find the technique helpful. It is apparent that the method is too slow and costly for production use, but it is useful for making a small number of items, in which precision is of primary importance and cost is secondary.

## TESTING-MACHINE BEARINGS BORED WITHOUT A JIG




**Testing-machine** bed with its two brackets and main bearings is mounted on a milling machine. Lower support pads for the boring bar can be seen on the far bracket, as can the flexible pressure pad above. Cutting tools can be mounted in each end of the bar, and both bearings bored without changing the position of the bar

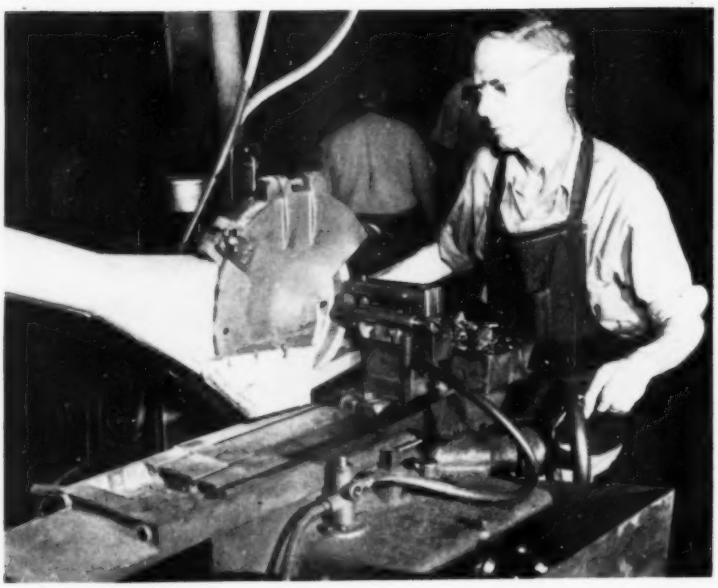
## *Tips* FOR TOP SHOP MEN

**271** Superior people are uncommon. It's your job to take average people and get them to do superior work.

**272** Study the trends and statistics, and be guided by them—but never forget that your customers, your suppliers and your workers are not statistics, but people.

**273** No two workers are alike, either in method of working or in temperament. Remember this when you teach methods or attempt discipline.

*"I don't care if you do feel that there are too many automobiles on the road as it is—we'd appreciate if you'd continue your small effort in behalf of your wage."*



**Handwheel traverse** on Covel cup-wheel face grinder actuates air valve through plate cam on table. This opens and closes clamp jaws automatically on small sewing-machine parts which are ground to 0.0005-in. tolerance. The ¼-in. dia. vertical cylinder operates with a ½-in. stroke. Operator uses right hand only to place parts between jaws of the clamping device

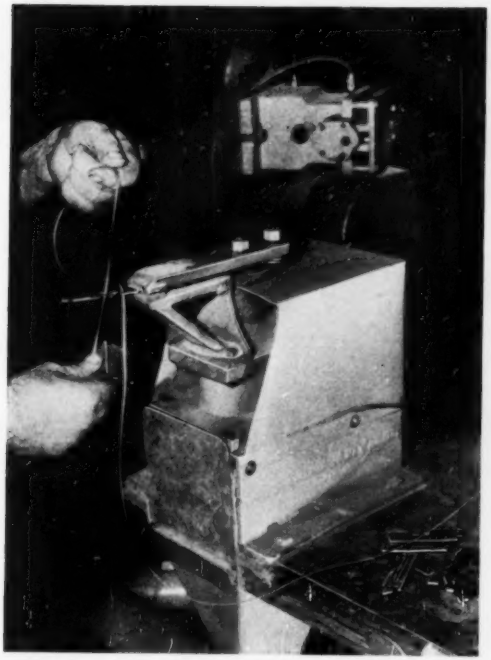
# AIR CLAMPS UNLOAD WORKERS' HANDS

BY J. V. CARLSON, Factory Superintendent, UNION SPECIAL MACHINE CO.

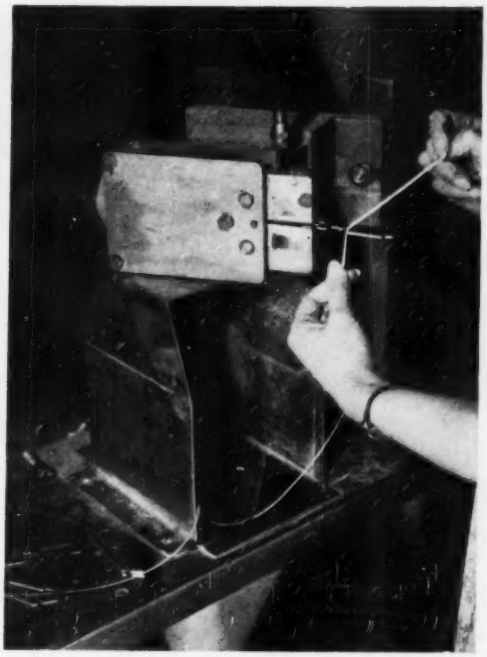
RECOGNIZING that the time required for locating and clamping parts in fixtures for machining operations often equals or exceeds the time needed for the cut itself, tool and production engineers at Union Special Machine Company have turned to air-operated fixtures in a number of applications to reduce over-all operation time. Some of the applications of standard and special air-operated fixtures now in use are illustrated.

Wherever possible, cam- or pedal-operated valves control these fixtures, so the operator's hands are free for locating parts and removing finished pieces. Air fixtures have been found advantageous because of their quick, positive clamping action, the reduction in operator fatigue they make possible, and the ease with which such fixtures can be adapted for a variety of parts within their capacity.

**Drilling and reaming spindles,** powered by Hamilton-Muehlmatt units for close precision, are fed by double-acting air cylinders. The drilling units were removed from their columns and placed horizontally, with one fixed and one adjustable along the bed. Automatic cycle is adjustable to feed both chucks at once or alternately at varied speeds

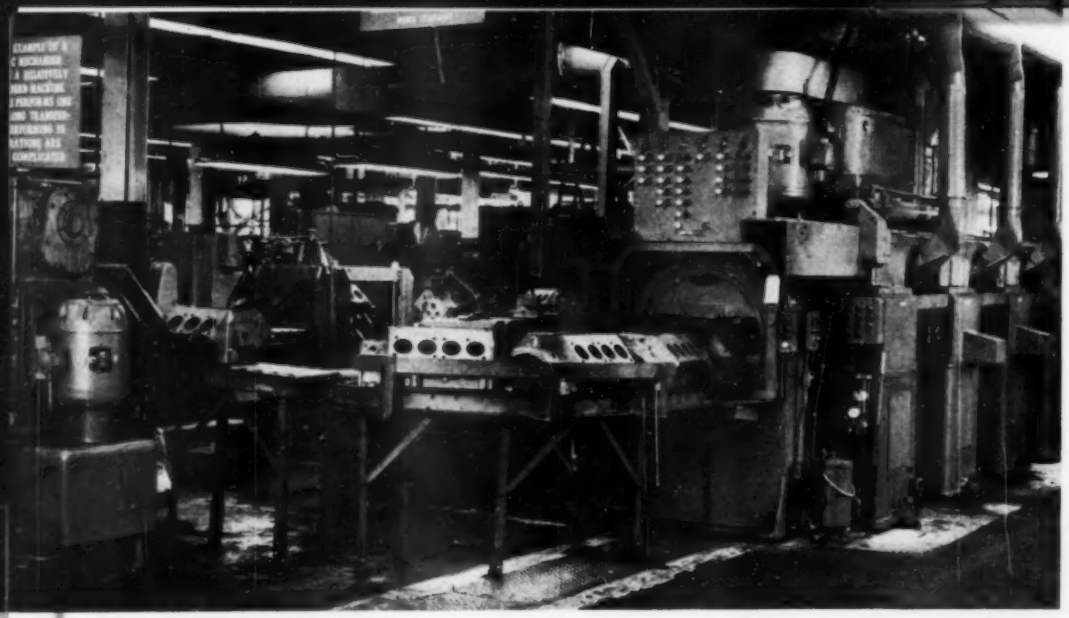


**Radii** are hand-polished on small parts with ⅛-in. abrasive tape, while special jaws on Snow down-acting air clamp grip the work. Fixture base is mounted on welded-steel pedestal bolted to bench above dust-collecting outlet



**Pedal valve** controls Snow air-operated vise fixture mounted on its side by bolts through welded-steel angle plate. Operator has both hands free for polishing sewing-machine parts with ⅛-in. abrasive tape

**Needle bars and shafts,** transferred from an Aero-Case salt bath to the quenching tank by the operator's tongs, are clamped between rotating rollers in air-operated jaws and lowered into the tank. Air cylinders open jaws at the top of the stroke, close them as the jaws lower the parts into the Lindberg automatic quenching machine. At the bottom of the stroke, the jaws open and air jets eject the parts. Shafts from ¼ to ½ in. dia. and up to 12 in. long are handled by the caster-mounted special quenching unit



**Cylinder blocks are qualified** in fixtures (center background). Locating pads are then milled on machine at left, after which blocks enter an 86-ft.-long shuttling machine with 18 stations that mill the top, bottom, two angular faces, and mill and broach the channel for the main bearing cap

# OLDS' V-8 BUILT WITH ULTRA-MODERN TOOLS

**Here's a case that engineers dream about: a free hand to lay out and equip a new plant according to the best thinking**

BY CHESTER S. RICKER
DETROIT EDITOR

IN PEACETIME, few production executives get the chance to lay out and equip a whole new plant. But management's decision to use the new "Kettering design" V-8 engine in the 1949 Oldsmobile created the need for new engine-building facilities. And with the likelihood that the V-8 engine will be little changed during a production life of five to ten years, it was practical to spend several million dollars on a plant to embody the very latest ideas in layout, machining practice, inspection, assembly and materials handling.

In starting from scratch, the Methods Engineering Department and the Production Engineering Department sought ideas from the maintenance and operating departments at Oldsmobile, from other GM divisions and from machine-tool and equipment builders. With processing and assembly operations decided, they laid out the plant to scale, built a 3-dimensional model for checking purposes, planned in detail the location and arrangement of machines, conveyors, lighting and ventilation, services for compressed air, water and power, aisles and stock areas.

From almost every vantage point, this plant presents unusual features: new combinations of machining methods, shuttling and transfer movement of work; automatic machine balancing of moving parts, overhead conveyors; new type of engine assembly line; unitized system of material handling; unusual inspection equipment to qualify parts; wide use of inserted-carbide tools; unusual cleanliness by providing adequate under floor chip disposal; cleaned air for good working conditions and preventing contamination of assemblies; high shadowless illumination by fluorescent lighting.

Practically all parts of the engine are machined, except for camshaft and crankshaft, in the new plant. About 300 special machines are operated by 800 people. Wherever possible, transfer-type or shuttle machines are used. Shuttling of parts has been developed in several new ways. On some machines the cutting heads move in one direction while the conveyor moves in the opposite direction. On some other machines, the heads and conveyors move in the same direction.

Equipment of considerable length or number of stations is common. One machine is 86 ft. long and has 18 work stations. During passage through this ma-

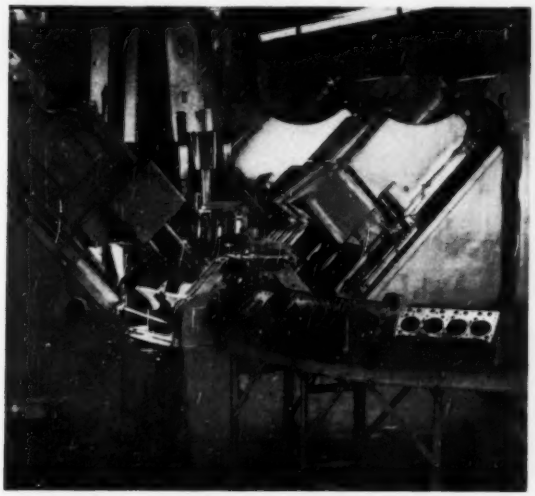
chine, the cylinder block is turned 180° automatically at one station for milling the ends. At another station, the block is somersaulted to finish opposite surfaces. Electric eyes prevent shuttling if a turn-over or turn-around unit has not returned to proper position for receiving the piece.

Carbide tools are used for boring, milling and broaching. One machine cuts cast iron at the rate of 56 ipm., another at 80 ipm. Rough-boring the cylinders at 9½ ipm. takes off 18 lb. of cast iron in one pass.

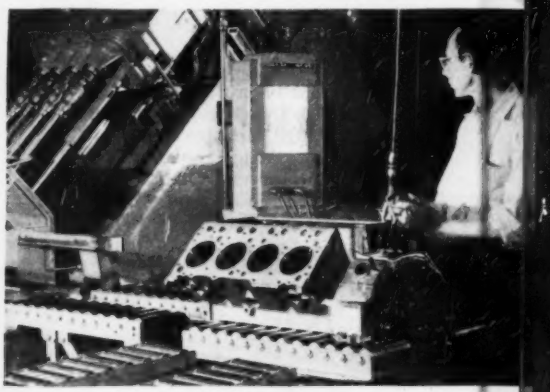
A new-design connecting rod has lugs on both the piston and the crankshaft ends. It is placed on a duplex balancing machine that weighs both ends of the rod simultaneously. Then it is machined on a special miller with two cutters, one for each end of the rod. The settings indicated by reference numbers on the scales are merely transferred to the new machine and the start button pressed. Just the right amount of metal is taken off each end of that rod to bring it to a standard weight.

Inspection is meticulous. On cylinder bores and pistons the latest-type air-gaging devices are used. For example, each cylinder bore is checked at four different points and stamped with the proper classification for selective assembly with a matching piston. Diameter, roundness, taper and bell-mouth of four cylinder bores in one cylinder bank are checked and the bores classified simultaneously in a matter of seconds. A total of eight different cylinder-bore sizes are allowed, half the number for the previous 8-cylinder "in-line" engine.

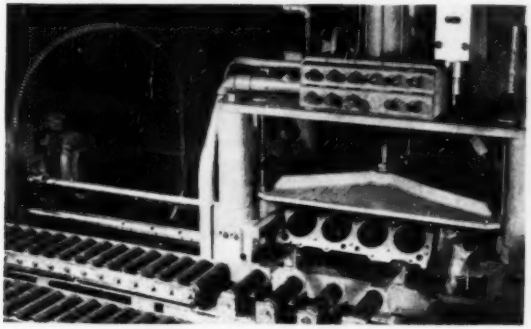
Another machine inspects 500 pistons per hr., and stamps them



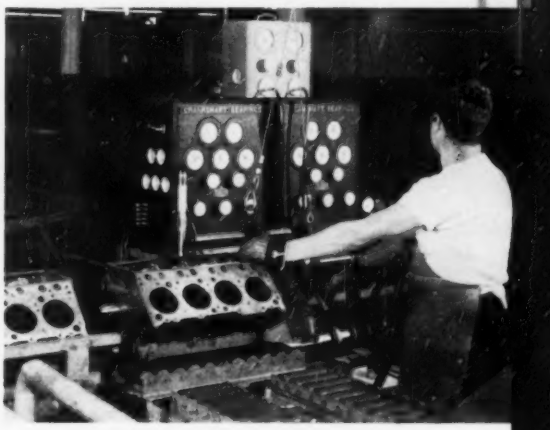
**All small holes are finished** when the cylinder block emerges from this bank of drilling and tapping machines. Other machines in the line bore the cylinders and mill the bearing-cap faces



**Air gages** check diameter, bell-mouth and roundness of cylinder bores. Cylinder diameters are numbered on the block, sizes are teletyped to assembly, where matching kits of connecting rods and pistons are made ready



**Line reamers** finish the main-bearing and camshaft-bearing holes in the cylinder block. Clamping is hydraulic



**Air gages** are also used to inspect the holes for the camshaft and main bearings

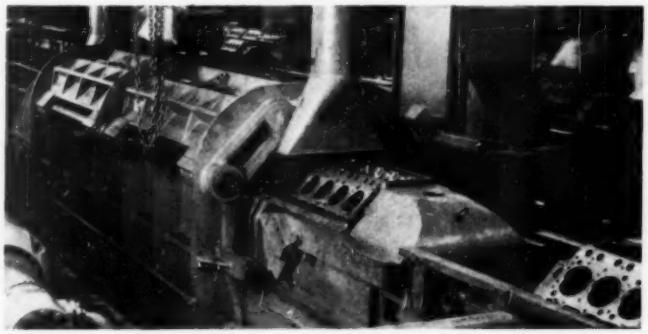
in two places with the proper classification, based on eight diameters in 0.0002-in. increments of the piston skirt. Piston-pin holes are inspected and size stamped on the piston. At the same time a small red light indicates the proper one of eight lines of a conveyor in which the operator should place the inspected piston. This conveyor acts as a parts-storage unit and is familiarly called the "Roller Skate Machine," because the pistons are fed through it by gravity. The pistons do not roll, but sit upright on the roller-skate wheels, 52,000 of which are used in this one unit.

All conveyors above the floor are designed to deliver parts and sub-assemblies to the worker at a uniform height of 38 to 40 in. In certain sections where operations are in parallel, the conveyors are moved manually. The same is true of intermediate roller conveyors where the line reverses direction. At these points a "cushion" of several hours stock is kept to assure full line production even when replacing tools.

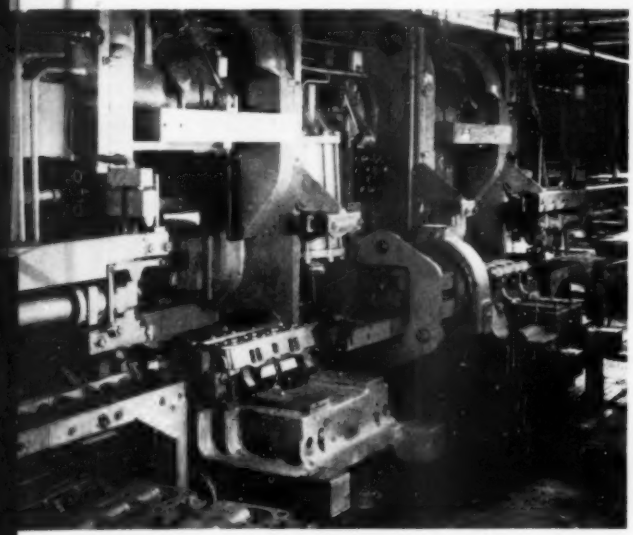
Double handling of incoming and outgoing stock has been eliminated. Incoming stock is fed onto the conveyor system from unloading docks; finished motors are trucked away as they come off the test stands. Some stock is brought direct to point of use on fork-truck pallets.

Chip conveyors, located under the floor immediately beneath each machine, catch chips and turnings. This conveyor system has a capacity of 3½ tons of chips per hour. In addition, an air-suction, dirt-collection system, designed to remove air-borne dust and dirt from the air in the plant, is also serviced by the chip-conveyor system. This dust-collecting system is carried on a mezzanine gallery which extends almost the entire length of the shop. Air-borne dust is thus removed from all the cast-iron fabricating machines. Hoods are placed over the cutters for this.

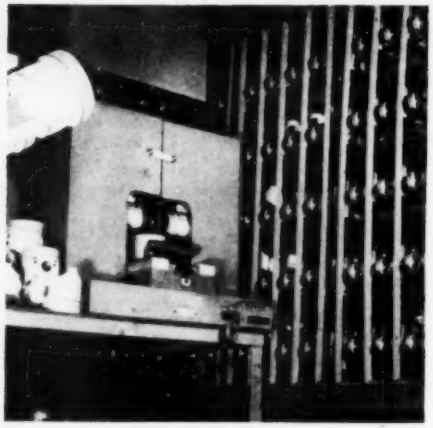
The air-conditioning system handles 164,000 cu.ft. of air per min. Introduced behind the assembly line, fresh air carries dust particles toward the machining areas where they originate. At



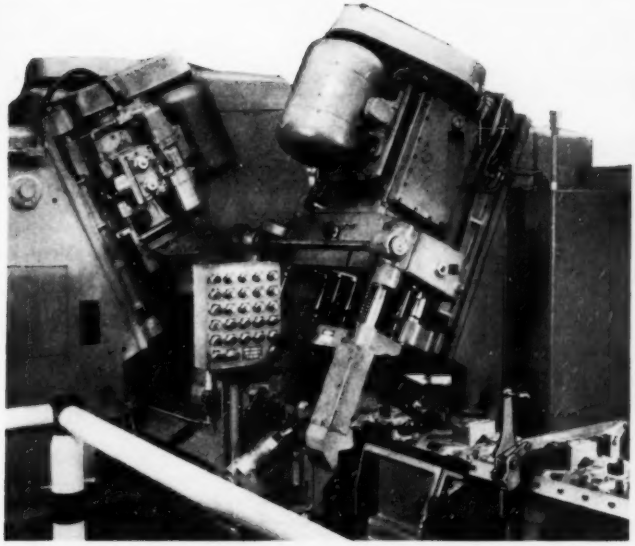
**Cylinder-head faces** are broached with inserted-carbide cutters. As the cable-operated shuttle moves left to put a block into starting position, the hinged work backstop (with eyebolt) swings up

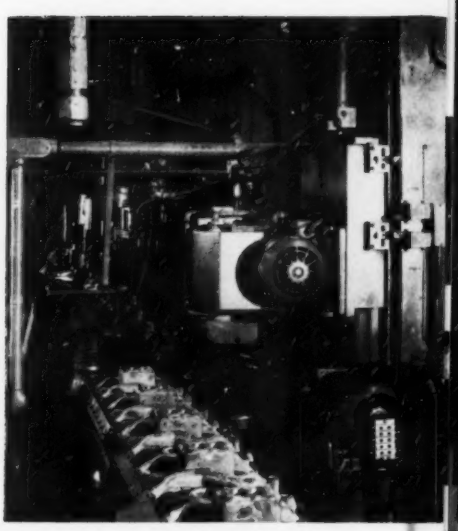


**Both faces of cylinder heads are milled** (to get through scale) and then broached on the two-station machine. At first station, cylinder head is clamped in trunnion-mounted fixture, which swings to vertical and is clamped during milling and broaching cycles. When fixture returns to horizontal, the partially machined cylinder head is pushed into a roll-over fixture and thence to the second station for milling and broaching the second face

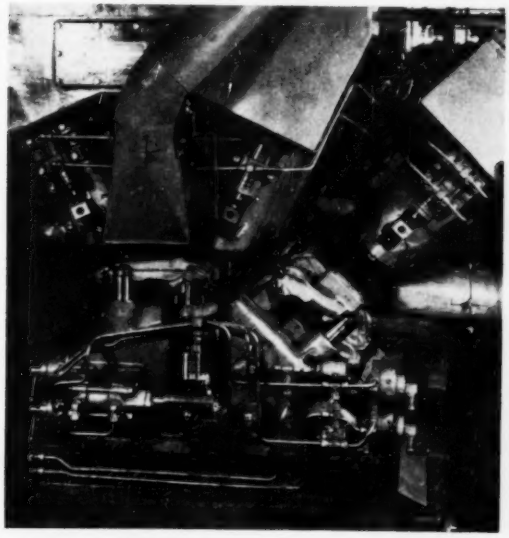


**Inspection of pistons** for diameters of skirt and piston-pin hole is handled at a rate of 500 pcs. per hr. Correct size is stamped automatically on piston, it is ejected, and a red lamp lights at proper section of classification rack at right. This "roller-skate" stock-bin conveyor feeds classified pistons upright to assembly by gravity

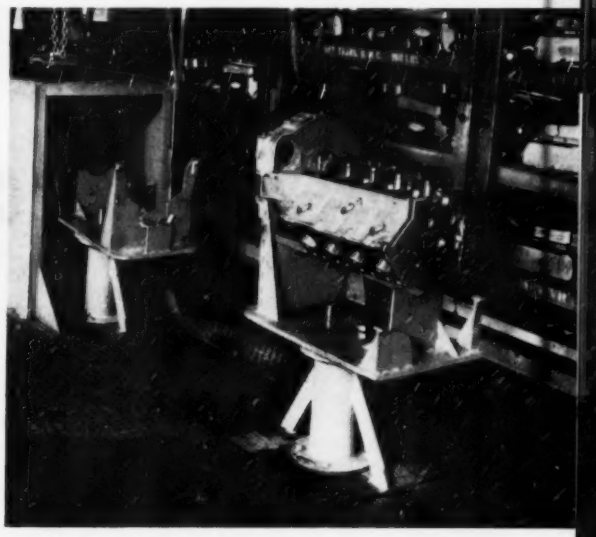




**All holes in intake manifolds** are drilled or drilled and tapped on this shuttle-type machine. Some heads are inclined, as at entering end of machine, *left*, and a cylinder tips up the fixture to suit. Conveyor has an offset for head clearance, as seen from emerging end of machine, *right*.



**Intake manifolds** are milled on this special multiple-head machine which makes them ready for drilling and tapping. Port pads are milled on left-hand fixture, part is then transferred to right-hand fixture for milling the carburetor flange

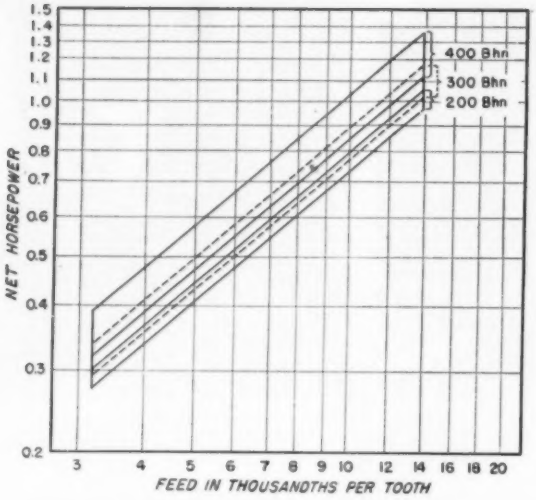


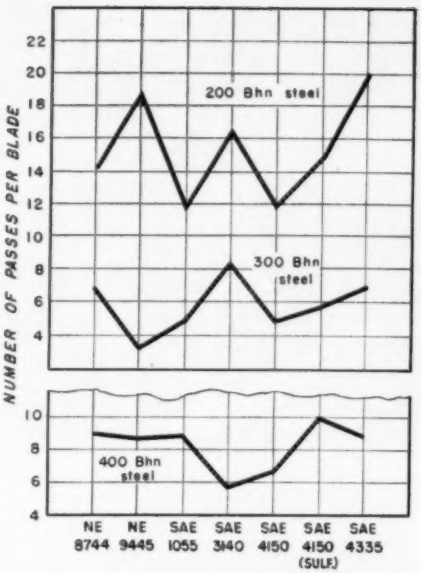
**Pedestals support the crankcase** during engine assembly, are mounted on steel floor plates attached to the intermittently moving conveyor chain. Men work from both sides of the line, take stock parts from bins an arm's length away.

night, partially assembled engines are covered with canvas hoods.

Fluorescent lighting equipment provides 50 to 80 foot-candles of glareless and shadowless light. To eliminate heat and glare from the sun on the exposed east side of the building, a special type of tinted glass has been employed.

The new engine plant at Oldsmobile is decorated with a specially developed paint, selected to reduce eye strain and mental fatigue. All machinery purchased by Oldsmobile was finished in this special green paint, and all equipment installed has been similarly covered. Flammable materials are packed in red boxes, yellow with black stripes marks hazardous elements, blue shows electrical boxes.




**Hardness Is Only an Approximate Indicator**.. Horsepower consumption when milling 300-Bhn steel is only 10% greater than for 200-Bhn steel; for 400-Bhn steel only 25% greater. But tool life is adversely affected by hardness and composition. Output loss per grind is approximately two-thirds when hardness is increased from 200 to 300 Bhn. Sharp reductions in speed and feed are required to mill 400-Bhn steel

# HARDNESS... A MACHINABILITY INDEX?

BY J. B. ARMITAGE, Vice-President and A. O. SCHMIDT, Research Engineer

KEARNEY & TRECKER CORPORATION

TO ESTABLISH preliminary speed and feed rates, the hardness of steel is often taken as an index of machinability. In general, this practice is satisfactory when production or tool-life tests are unavailable. However, tool life and optimum production are affected by composition of steel as well as hardness.

In order to throw more light on this subject, comparative horsepower and tool-life tests were made on seven representative steels heat-treated to approximate Brinell hardness values of 200, 300 and 400. Test cutters were 3-in. face mills with two solid tungsten-titanium carbide blades known to be suitable for most carbide milling operations on steel. Blades were ground to 12° negative radial rake, 0° axial rake and 15° corner angle.

For tool-life tests, the various steels in the 200- and 300-Bhn groups were face-milled at 430 fpm., 0.125-in. depth of cut and 0.0115-in. feed per tooth. For 400-Bhn samples, tool-life was practically zero until the cutting speed was reduced to 130 fpm. and the feed to 0.0045 in. per tooth.

These tool-life tests are confirmed by shop experience, from which general recommendations derived are:

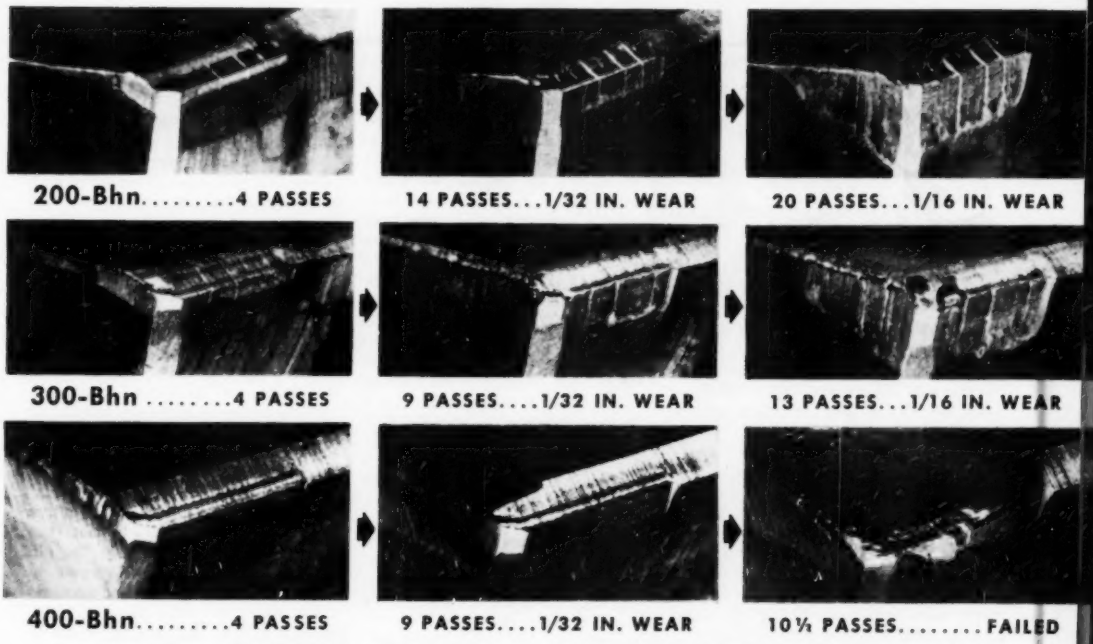
| | CUTTING SPEED, FPM. | FEED PER TOOTH, IN. |
|---|---|---|
| Mild Steels to 200 Bhn | 350—800 | 0.010—0.020 |
| Medium Steels about 300 Bhn | 250—400 | 0.007—0.015 |
| Hard Steels about 400 Bhn | 150—300 | 0.003—0.010 |

For finishing, use speeds in the upper part of the recommended range; for roughing, the opposite procedure.

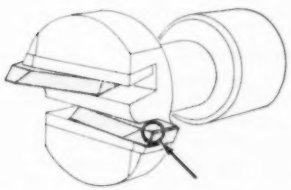
Wear tests were made with only one blade cutting. After 1/32-in. peripheral wear occurs, the *rate* of wear increases rapidly and the likelihood of spalling, chipping and breakage becomes greater.

It was obvious in these tests that machine rigidity and optimum cutter design are increasingly important as the hardness of alloy steels increases.

# PROGRESSIVE WEAR OF TUNGSTEN-TITANIUM CARBIDE BLADES




**Blade Wear Mounts with Material Hardness**.. Cutters should be reground when peripheral wear reaches 1/32 in. At this point, power consumption has increased 30 to 40% over sharp cutters, the few extra passes obtainable are not worth the extra reconditioning cost and possible tool breakage which are encountered



**This is the Cutter**.. The circled area is shown enlarged above

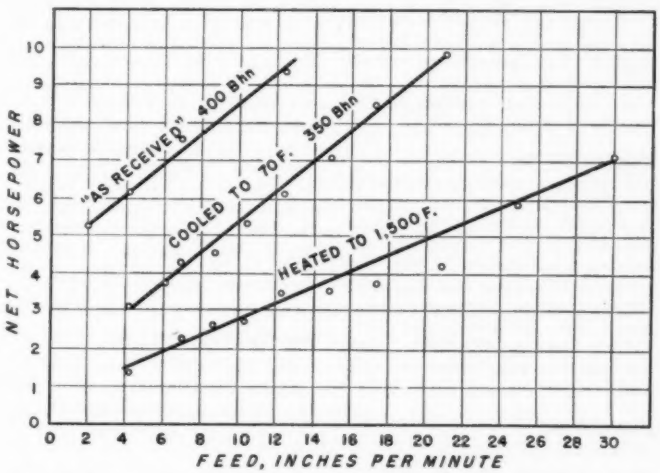
### Test Conditions

**For 200- and 300-Bhn steels:**

Cutting speed, 428 fpm.; depth of cut, 0.125 in.; feed, 0.011 in. per tooth. A slower cutting speed of 300 fpm. and a finer feed of 0.006 in. per tooth would have improved tool life on the 300-Bhn test bars

**For 400-Bhn steels:**

As tool life under the above conditions would have been practically zero, the cutting speed was set at 130 fpm. and the feed at 0.0045 in. per tooth




**Heated Workpieces Machine Easier**.. Die blocks in the "as received" condition could be face-milled at 0.250-in. depth of cut, 100 fpm. and 2 in. feed per min., with the cutter averaging 12 passes. By heating the work to 1500 F., much higher feed rates could be applied with much less power, and tool life was comparatively good

# TALKING SHOP

### Oxide Separator

TO ROLL THINNER GAGES of Monel and nickel sheet (down to 0.018 in.), the pack method is used by Inco at Huntington. Two slabs are rolled to sheet in four passes, reheated and given two passees as a pair, then doubled over, the joint hammered flat in a small floor-level hydraulic press, reheated and rolled to a given length that corresponds to the desired thickness, cooled, square-sheared and separated . . . But just before doubling over, the mill operator carefully pulls the sheets apart, then lets them fall back together. That, we discovered, allows a thin coating of oxide to form between sheets—and permits the pack to be separated after the folded-over joint is sheared off.

### Simplified

SPEAKING of the "simpler" turbo-jets, we hear each has 75 anti-friction bearings—ten times as many as their reciprocating predecessors. And what was the major shortage toward the end of World War II?

### Monocoque Bus

GMC TRUCK is building all bus bodies from sheet aluminum without any steel frame. Bodies are monocoque structures, riveted together, as aircraft were built during the war. This allows much greater flexibility than normal practice. Compound-curved panels are hammer-formed with Kirksite dies—much cheaper when the output is only a few thousand pieces.

### Heavy Case

IN CARBURIZING, cost increases as case depth increases. But, in induction hardening, a small depth costs more than a greater one—because it requires shorter-time higher current or higher frequency.

### Thin Rolling

SILICON-STEEL SHEET only 0.001 in. thick was rolled by Allegheny-Ludlum for special radar magnets during World War II. "Really, we didn't *roll* it; we *wore* it down!" explained one of the mill men, doing credit to the repeated passes necessary to achieve so thin a sheet . . . A-L is currently installing a German mill, captured by the Navy, reputed to be able to roll 0.0005-in. sheet. For such thicknesses, tremendous pressure is required and rolls must be small in diameter. This mill has rolls about 1 in. in diameter, each backed by a cluster (or inverted pyramid) of 2, 3, and finally 4 progressively larger rolls instead of the usual vertical row. Thus the mill is actually the equal of a 20-high conventional job. Rolls are held in jaws—like the halves of a clamshell—so adjustment for thickness is made at one side. Both coarse and fine adjustments are provided in the arms which hold the open side of the jaws.

### Chilled Flash

PROMINENT SUPPLIER of hydraulic parts for machine tools claims 90% of troubles with hydraulics is a result of faulty installation and maintennace, so is cooperating in maintenance training programs with Ford and G. M. Valve bodies, once machined from the solid, later were cast, now are press-forged . . . O-rings for precision valves must be compounded to suit the fluid; usually a different synthetic rubber is used for each fluid. But all have one common characteristic—a tiny flash or fin. To remove it, the rings are tumbled in solid carbon dioxide. The solid $CO_2$ hardens the rings enough so tumbling knocks off the flash.

### Greasy-handed Clerks

EATON MFG. CO. recently installed a central planning dept. with Productrol boards. Results are reduced costs, smoother production and increased safety, as expected. But, unexpectedly, untrained clerks caused trouble. Planning personnel now prefer to transfer men with shop experience into clerical jobs. They know what they're doing.

### Communist

TWO DETROIT definitions of a Communist:

. . . a fanatic who foolishly believes that someday Americans will make hammers and sickles at Valley Forge.

. . . one who would divide everything, even these United States.

### Early Bearings

EARLY LOCOMOTIVE BUILDERS tried a number of interesting experiments in bearings . . . The Grand Trunk Railroad, for example, tried out driving boxes of cast iron instead of brass. Their boxes were made in three parts, the top or center part being of brass or cast iron. The cast iron soon gave way to brass.

Then the old Grant Locomotive Works, Paterson, N. J., tried out main bearings of glass for the old Boston & Providence Railroad in about 1850. Later the Lackawanna tried water as a bearing lubricant, pumping it to the driving boxes to insure steady flow. This is reported to have worked well, but it took so much water that it drained the tanks of too much of what was needed for the boilers, so they went back to the long-necked oilcan that marked the old-time engineer.

### Self-Cleaners

BY INSTALLING equipment to dry-clean polishing tape, wiping cloths and work gloves, thus making these materials last longer, SKF Industries, Inc., estimates it will save in excess of $30,000 annually. Placed in operation in December, the equipment is the first of its kind to be applied in an industrial plant.

*How to*

**Machine**

# Beryllium Copper

BY JOHN T. RICHARDS, DESIGN ENGINEER, THE BERYLLIUM CORPORATION

**Beryllium copper has the highest endurance strength and greatest wear resistance of all non-magnetic materials. In addition, it offers good electrical and thermal conductivity combined with corrosion resistance equal to deoxidized copper. These properties are making beryllium copper widely used for both electrical and mechanical applications.**

**An important factor in machining is the method of heat-treatment in two steps: Solution annealing treatment is performed by the mill. Hardening is generally done by the fabricator after machining. This means that work is machined in the soft condition, then given a simple, low-temperature heat-treatment which doubles the strength and hardness.**

**Beryllium copper is not a free-cutting material, but can be readily machined with proper tools, cutting fluids, speeds and feeds, in a manner similar to phosphor bronze or copper. This report summarizes current machining practice for the 2% high-strength alloy, which is the one in common use today.**

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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ALTHOUGH several beryllium copper wrought and casting alloys are available, the high-strength alloy of nominal 2% beryllium content is the most important at the present time. The 0.4% high-conductivity alloy, although of less commercial significance today, is finding increased use. The accompanying table lists properties and compositions of these two alloys in both wrought and cast forms.

The 2% high-strength alloy is generally machined in unhardened condition, necessitating heat-treatment of parts to obtain maximum properties. The high-conductivity alloy, on the other hand, is usually machined in the heat-treated condition, and the hardening operation may be eliminated by ordering this alloy from the mill fully hardened.

## To Remove Oxide Scale

Beryllium copper oxidizes when heated into either the hardening or annealing ranges. When machining wrought or cast parts covered with oxide scale, the depth of cut should be great enough to keep the tool buried. On the other hand, the oxide film may be removed by this pickling procedure:

(1) Immerse in 15-25% by volume solution of sulfuric acid and water. Bath should be heated to 135-165 F. with parts held in solution approximately 10-30 min. or until dark scale disappears.

(2) Rinse thoroughly in cold water.

(3) Follow with a bright dip for 15-30 sec. in a cold solution of 15-30% by volume nitric acid and water.

(4) Rinse thoroughly in cold water.

(5) (Optional bright dip for applications requiring the best surface condition or appearance.) Immerse for 15-30 sec. in a cold solution of 15% by volume sulfuric acid to which is added 4 ounces of sodium dichromate to each gallon of solution.

(6) Rinse thoroughly in cold water.

(7) Wash in hot neutralizing bath of trisodium-phosphate heated to approximately 150 F.

(8) Dry thoroughly by air blast or other available means.

*Note:* Agitation speeds up process and should be used whenever possible. Steps 5 and 6 should be included only when a bright surface is required.

In the interest of simplicity, the balance of this report covers the machining characteristics of the 2% high-strength alloy only. All references to beryllium copper or to various tempers or conditions, such as annealed, cold-worked or heat-treated, refer to this alloy.

Although beryllium copper may be machined in any condition, the cold-worked tempers (cold rolled or cold drawn) offer best machinability for most turning, milling, shaping, planing, tapping, threading, sawing, and screw-machine operations. Whenever possible, annealed material should be used for drilling and reaming, while polishing and finish-grinding operations should follow the hardening heat-treatment. Since certain large rod and bar sizes are not cold drawn, they must be machined in the annealed condition. Similarly, castings must be machined either annealed or as-cast. In the case of multiple machining, the temper will be determined by the most critical operation; although the temper may frequently be dictated by the required final properties.

On the basis of machining characteristics, beryllium copper in the heat-treatable condition can be classed with such ductile, non-leaded copper alloys as phosphor bronze, aluminum bronze, nickel silver, silicon bronze and cupro-nickel. In the annealed condition, beryllium copper is rather gummy and handles like copper; while in the cold-worked condition, beryllium copper will work-harden rather rapidly and in this respect it can be compared to phosphor bronze or 18-8 stainless steel. On account of this tendency to work-harden, it is not advisable to take a light cut. The depth of cut should always be enough to get under the work-hardened layer.

## Cutting Fluids

Cutting fluids in machining beryllium copper give higher cutting speeds, longer tool life, lower power consumption, good chip removal, and better surface finish.

For beryllium copper, the most important function of a cutting fluid is the removal of heat. A coolant gives increased tool life by cooling tool and at the same time prevents distortion and thermal expansion in the work. Since beryllium copper is a heat-treatable alloy, it will harden with pro-

### Heat-Treating Recommendations

| Condition before hardening | | 2% High-strength alloy Hours at 600 F. | 0.4% High-conductivity alloy Hours at 900 F. |
|---|---|---|---|
| Wrought | Annealed | 3 | 3 |
| | Cold-worked | 2 | 2 |
| Cast | As cast | 3 | 3 |
| | Annealed | 3 | 3 |

Note: Times apply for a circulating-air furnace. Hardening in a muffle furnace will require a longer time, while a salt bath requires about 25% less time. In all cases, time is the length of time parts are held at temperature, excluding time required to reach temperature.

### Machinability Under Various Conditions

(Tempers on same horizontal line have equivalent characteristics)

| 2% HIGH-STRENGTH ALLOY | | 0.4% HIGH-CONDUCTIVITY ALLOY | |
|---|---|---|---|
| Wrought | Cast | Wrought | Cast |
| Annealed | As cast | Annealed | As cast |
| | Annealed | Cold-worked | Annealed |
| Cold-worked | | Heat-treated | Heat-treated |
| Heat-treated | Heat-treated | | |

## CUTTING FLUID RECOMMENDATIONS

| TYPE OF OPERATION | CUTTING FLUID | REMARKS |
|---|---|---|
| Turning, Single-point tools | Soluble oil | Concentration for high-speed steel: 10-1 to 30-1<br>Concentration for carbide: 50-1 |
| Automatic screw machines | Mineral lard oil | 3-7% Lard oil |
| | Sulfurized mineral lard oil | 7% Lard oil* |
| Shaping and planing | Soluble oil | Concentration: 10-1 to 30-1 |
| Drilling | Soluble oil | Concentration: 10-1 to 30-1 |
| Deep drilling | Mineral lard oil | 3-7% Lard oil |
| | Sulfurized mineral lard oil | 7% Lard oil* |
| Reaming | Soluble oil | Concentration: 10-1 to 30-1 |
| | Mineral lard oil | 3-7% Lard oil |
| Tapping | Mineral lard oil | 3-7% Lard oil |
| | Sulfurized mineral lard oil | 7% Lard oil* |
| | White lead | Occasionally used for hand tapping |
| Threading | Mineral lard oil | 3-7% Lard oil |
| | Sulfurized mineral lard oil | 7% Lard oil* |
| Milling | Soluble oil | Concentration: 10-1 to 30-1 |
| | Mineral lard oil | 3-7% Lard oil |
| | Sulfurized mineral lard oil | 7% Lard oil* |
| Sawing | Soluble oil | Concentration: 20-1 to 50-1 |
| Grinding | Soluble oil | Concentration: 30-1 to 80-1 |

*Total sulfur content (combined and added) not more than 3%. Use with caution.

longed heating at 550 F.; so that some care should be exercised when taking heavy cuts for any length of time without a coolant. At 700 F., hardening will begin to take place almost immediately with an appreciable degree observable in as little as five minutes.

The lubricating properties of cutting fluids reduce the power requirements for removing metal and also reduce tool wear. In addition, a lubricant aids in providing a good surface finish.

Cutting fluids also assist in chip removal for operations such as sawing and drilling.

For applications in which the removal of heat is of primary importance, emulsions formed from soluble oils give good results on account of their excellent cooling properties. These emulsions, which have a milk-white appearance, vary from 10 parts water and 1 part oil up to 80 parts water and 1 part oil. Depending upon their sulfur content, soluble oils may cause spotting and should be removed with warm water.

Although mineral lard oils do not cool as effectively as emulsions of soluble oils, they offer superior lubricating properties. In addition, mineral lard oils will not leave surface stains. Oils of low viscosity offer good penetrating and cooling properties required for severe operations such as hand tapping. Cutting fluids with 3 to 7% lard oil added to a mineral-oil base offer the greatest versatility in machining beryllium copper, because they can be depended upon to give good results in most operations.

Sulfurized oils (such as sulfurized mineral lard oils) offer, for the more difficult machining operations, the best combination of lubricating, penetrating, and surface-finishing characteristics. The high film strength of these oils is helpful in work requiring the heavy loads and high speeds encountered in screw-machine work.

As sulfurized oils will stain beryllium copper, parts must be cleaned as soon as possible after machining. Immediately after parts come off the machine, they should be immersed in a suitable solvent such as mineral spirits (Stoddard Solvent) to prevent staining. If a solvent is not used immediately and the material stains, the discoloration can be removed by leaving parts for 20 to 30 min. in a cold bath of a 10% solution of soduim cyanide. Extreme caution should be used in handling sodium cyanide, because this solution is a deadly poison.

When cutting fluids are used, they should be applied in sufficient quantities to flood the tool point where the chip is being formed. It is generally advisable to supply a large volume of oil through a large tube, as oil forced through a small tube under pressure may splash away from the work. In all cases, the oil flow should be continuous and not

# TYPICAL CHARACTERISTICS OF

| ALLOY | HIGH STRENGTH | | | |
|---|---|---|---|---|
| FORM | WROUGHT | | | |
| COMPOSITION | Beryllium – 2.0%<br>Cobalt – 0.3%<br>Copper – Balance | | | |
| CONDITION and HEAT-TREATMENT | HEAT-TREATABLE | | HEAT-TREATED 2-3 hours at 600°F. | |
| TEMPER and CONDITION | ANNEALED | COLD WORKED | ANNEALED AND HEAT-TREATED | COLD WORKED AND HEAT-TREATED |
| **Physical Properties** | | | | |
| Specific Gravity | 8.21 | 8.21 | 8.26 | 8.25 |
| Density—lb. per cubic inch | 0.296 | 0.296 | 0.298 | 0.298 |
| Specific Heat (30°-100°C.)-cal. per gram per °C. | 0.10 | 0.10 | 0.10 | 0.10 |
| Magnetic Properties | Non-magnetic | Non-magnetic | Non-magnetic | Non-magnetic |
| Melting Temperature (Liquidus)- °F. | 1750 | 1750 | 1750 | 1750 |
| Annealing Temperature- °F. | 1400-1475 | 1400-1475 | 1400-1475 | 1400-1475 |
| **Average Coefficient of Linear Expansion** Per deg. C. 20°-100°C. | 0.0000166 | 0.0000166 | 0.0000166 | 0.0000167 |
| 20°-200°C. | 0.0000171 | 0.0000169 | 0.0000170 | 0.0000170 |
| 20°-300°C. | 0.0000178 | 0.0000178 | 0.0000176 | 0.0000178 |
| Per deg. F. 68°-212°F. | 0.0000092 | 0.0000092 | 0.0000092 | 0.0000093 |
| 68°-392°F. | 0.0000095 | 0.0000094 | 0.0000094 | 0.0000094 |
| 68°-572°F. | 0.0000099 | 0.0000099 | 0.0000098 | 0.0000099 |
| **Hardness** Rockwell number | B50-65 | B85-95 | C36-41 | C38-44 |
| Approximate Brinell number | 83-110 (500kg.) | 165-210 (3000kg.) | 305-382 (3000kg.) | 352-415 (3000kg.) |
| **Tensile properties** Ultimate tensile strength- psi. | 60,000-80,000 | 90,000-100,000 | 165,000-180,000 | 180,000-210,000 |
| Elongation in 2 in., % | 35-50 | 10-20 | 3-12 | 2-8 |
| Reduction of area, % | 40-70 | 25-45 | 5-15 | 3-10 |
| Proportional limit (0.002% offset)- psi. | 15,000-20,000 | 50,000-60,000 | 70,000-80,000 | 95,000-105,000 |
| Elastic limit (0.002% permanent set)- psi. | 15,000-20,000 | 55,000-65,000 | 75,000-85,000 | 100,000-110,000 |
| Yield strength: | | | | |
| (0.01% offset)- psi. | 17,000-22,000 | 65,000-75,000 | 85,000-95,000 | 110,000-120,000 |
| (0.20% offset)- psi. | 25,000-35,000 | 75,000-85,000 | 130,000-150,000 | 160,000-175,000 |
| (0.50% strain)- psi. | 30,000-40,000 | 70,000-80,000 | 85,000-95,000 | 90,000-100,000 |
| Elastic modulus in tension (20°C.)- psi. | 17,000,000 | 17,000,000 | 19,000,000 | 19,000,000 |
| Thermoelastic coefficient in torsion- psi. | – – – | – – – | 0.00035 | 0.00035 |
| **Torsion properties** Proportional limit in torsion- psi. | – – – | 45,000-50,000 | – – – | 65,000-70,000 |
| Elastic modulus in torsion- psi. | 6,500,000 | 6,500,000 | 7,300,000 | 7,300,000 |
| Thermoelastic coefficient in torsion- psi. | – – – | – – – | 0.00033 | 0.00033 |
| **Compressive strength** Maximum compressive strength- psi. | – – – | 125,000-140,000 | – – – | 205,000-230,000 |
| Compressive stress to produce permanent deformation of | | | | |
| (0.10% in 1 inch)- psi. | – – – | 80,000-90,000 | – – – | 180,000-200,000 |
| (1.00% in 1 inch)- psi. | – – – | 105,000-120,000 | – – – | 200,000-220,000 |
| **Shearing strength**- psi | 50,000-60,000 | 65,000-75,000 | 90,000-100,000 | 95,000-110,000 |
| **Impact strength**- Energy absorbed in ft.-lbs. | 50-65 | 15-25 | 5-10 | 5-10 |
| **Fatigue strength** at 100,000,000 load-cycles: | | | | |
| Flat strip- reverse bending- psi. | 30,000-35,000 | 35,000-40,000 | 35,000-40,000 | 40,000-48,000 |
| Round rod-rotating beam- psi. | – – – | – – – | 45,000-60,000 | 45,000-60,000 |
| **Electrical properties** | | | | |
| Electrical conductivity (% I. A. C. S.)- 20°C. | 18-20 | 15-17 | 25-29 | 22-25 |
| Electrical resistivity (microhm centimeters)- 20°C. | 9.07 | 10.78 | 6.38 | 7.19 |
| 200°C. | 10.87 | 12.72 | 7.87 | 8.35 |
| Temperature coefficient of resistivity (20°-200°C.)-20°C. | 0.0011 | 0.0010 | 0.0013 | 0.0009 |
| **Thermal properties** | | | | |
| Thermal conductivity | | | | |
| (BTU/sq. ft./in./hr./°F.)- 68°F. | 621 | 468 | 864 | 792 |
| 392°F. | 720 | 576 | 972 | 936 |
| (cal./sq. cm./cm./sec./°C.- 20°C. | 0.21 | 0.16 | 0.30 | 0.27 |
| 200°C. | 0.25 | 0.20 | 0.34 | 0.33 |
| Temperature coefficient of thermal conductivity (20°-200°C.) | 0.0011 | 0.0014 | 0.0007 | 0.0012 |

intermittent, because rapid changes in temperature are injurious to tool materials.

Because beryllium copper parts are heat-treated after machining, it is necessary to remove thoroughly all cutting fluids before hardening; otherwise there may form surface compounds which discolor the part and are difficult to remove.

## Turning

**Cutting Procedure** . . . The ductility of annealed beryllium copper causes some plastic deformation or upsetting to take place prior to actual shearing. This plastic working absorbs power and produces heat, decreasing tool life. In addition, the severely

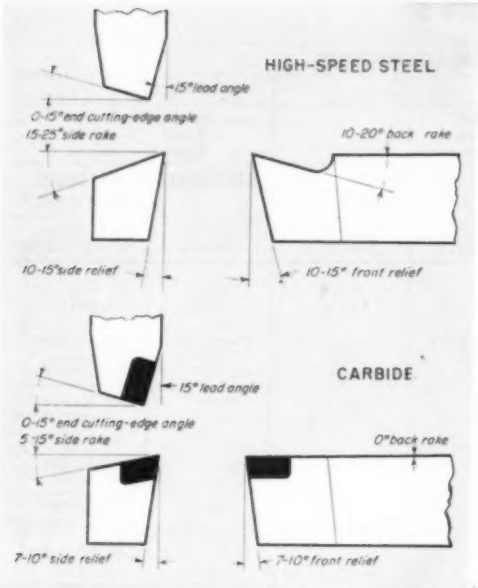
# BERYLLIUM—COPPER ALLOYS

| HIGH CONDUCTIVITY | | | | | | | |
|---|---|---|---|---|---|---|---|
| CAST | | WROUGHT | | | | CAST | |
| Beryllium — 2.0%<br>Cobalt — 0.5%<br>Copper — Balance | | Beryllium — 0.45%<br>Cobalt — 2.60%<br>Copper — Balance | | | | Beryllium — 0.60%<br>Cobalt — 2.60%<br>Copper — Balance | |
| HEAT-TREATABLE | HEAT-TREATED 3 hours at 600°F. | HEAT-TREATABLE | | HEAT-TREATED 2-3 hours at 900°F. | | HEAT-TREATABLE | HEAT-TREATED 3 hours at 900°F. |
| CAST AND ANNEALED | CAST, ANNEALED AND HEAT-TREATED | ANNEALED | COLD WORKED | ANNEALED AND HEAT-TREATED | COLD WORKED AND HEAT-TREATED | CAST AND ANNEALED | CAST, ANNEALED AND HEAT-TREATED |
| 8.04 | 8.09 | 8.70 | 8.70 | 8.75 | 8.75 | 8.60 | 8.62 |
| 0.290 | 0.292 | 0.314 | 0.314 | 0.316 | 0.316 | 0.310 | 0.311 |
| 0.10 | 0.10 | — — — | — — — | — — — | — — — | — — — | — — — |
| Non-magnetic | Non-magnetic | Non-magnetic | Non-magnetic | Non-magnetic | Non-magnetic | Non-magnetic | Non-magnetic |
| 1750 | 1750 | 1950 | 1950 | 1950 | 1950 | 1950 | 1950 |
| 1400-1475 | 1400-1475 | 1700 | 1700 | 1700 | 1700 | 1700 | 1700 |
| 0.0000166 | 0.0000166 | — — — | — — — | — — — | — — — | — — — | — — — |
| 0.0000171 | 0.0000170 | — — — | — — — | 0.0000178 | 0.0000176 | — — — | 0.0000178 |
| 0.0000178 | 0.0000176 | — — — | — — — | — — — | — — — | — — — | — — — |
| 0.0000092 | 0.0000092 | — — — | — — — | — — — | — — — | — — — | — — — |
| 0.0000095 | 0.0000094 | — — — | — — — | 0.0000099 | 0.0000098 | — — — | 0.0000099 |
| 0.0000099 | 0.0000098 | — — — | — — — | — — — | — — — | — — — | — — — |
| B55-70 | C37-42 | B25-50 | B65-80 | C20-24 | C23-28 | B30-45 | B90-100 |
| 100-125 (3000kg.) | 342-390 (3000kg.) | 64-83 (500kg.) | 116-150 (300kg.) | 230-250 (3000kg.) | 245-270 (3000kg.) | 67-79 (500kg.) | 185-240 (3000kg.) |
| 50,000-70,000 | 155,000-170,000 | 45,000-55,000 | 70,000-80,000 | 110,000-120,000 | 120,000-140,000 | 35,000-50,000 | 90,000-95,000 |
| 20-35 | 1-5 | 20-35 | 6-25 | 10-15 | 8-12 | 20-35 | 8-15 |
| — — — | — — — | 40-75 | 20-45 | 15-35 | 10-30 | — — — | 10-20 |
| — — — | — — — | 12,000-16,000 | 35,000-40,000 | 50,000-60,000 | 60,000-70,000 | — — — | 45,000-50,000 |
| — — — | — — — | 12,000-16,000 | 40,000-45,000 | 55,000-65,000 | 65,000-75,000 | — — — | 50,000-55,000 |
| — — — | — — — | — — — | — — — | 60,000-70,000 | 70,000-80,000 | — — — | — — — |
| 40,000-55,000 | 135,000-150,000 | 20,000-30,000 | 60,000-70,000 | 85,000-95,000 | 95,000-110,000 | 20,000-25,000 | 75,000-80,000 |
| — — — | — — — | — — — | — — — | 75,000-85,000 | 80,000-90,000 | — — — | — — — |
| 17,000,000 | 19,000,000 | 16,000,000 | 16,000,000 | 18,000,000 | 18,000,000 | 16,000,000 | 18,000,000 |
| — — — | — — — | — — — | — — — | — — — | — — — | — — — | — — — |
| — — — | — — — | — — — | — — — | — — — | — — — | — — — | — — — |
| 6,500,000 | 7,300,000 | 6,000,000 | 6,000,000 | 6,800,000 | 6,800,000 | 6,000,000 | 6,800,000 |
| — — — | — — — | — — — | — — — | — — — | — — — | — — — | — — — |
| — — — | 180,000-210,000 | — — — | — — — | — — — | — — — | — — — | — — — |
| — — — | 145,000-160,000 | — — — | — — — | — — — | 100,000-110,000 | — — — | — — — |
| — — — | — — — | — — — | — — — | — — — | — — — | — — — | — — — |
| — — — | 85,000-100,000 | — — — | — — — | — — — | — — — | — — — | — — — |
| 12-25 | 5-10 | 30-40 | 25-35 | 25-35 | 10-25 | 30-40 | 25-35 |
| — — — | — — — | — — — | 30,000 | 30,000 | 35,000 | — — — | — — — |
| — — — | — — — | — — — | — — — | 30,000 | 35,000 | — — — | 30,000 |
| 15-20 | 23-28 | 24-27 | 20-24 | 47-52 | 45-50 | 20-26 | 45-50 |
| 11.50-8.65 | 7.53-6.18 | 7.21-6.41 | 8.65-7.21 | 3.69-3.33 | 4.03-3.61 | 8.65-6.65 | 3.85-3.46 |
| — — — | — — — | — — — | — — — | — — — | — — — | — — — | — — — |
| — — — | — — — | — — — | — — — | — — — | — — — | — — — | — — — |
| 450-600 | 800-900 | 750-880 | 650-750 | 1600-1800 | 1400-1600 | 750-880 | 1600-1800 |
| — — — | — — — | — — — | — — — | — — — | — — — | — — — | — — — |
| 0.15-0.20 | 0.27-0.31 | 0.25-0.30 | 0.22-0.25 | 0.54-0.61 | 0.47-0.54 | 0.25-0.30 | 0.54-0.61 |
| — — — | — — — | — — — | — — — | — — — | — — — | — — — | — — — |
| — — — | — — — | — — — | — — — | — — — | — — — | — — — | — — — |

work-hardened chip that is formed has a high degree of strength and springiness, so chip removal may be difficult.

These problems—similar to those found in working any ductile material—may be largely overcome by using cold-drawn instead of annealed rod. Cold-drawn beryllium-copper rod should always be used for turning unless the cold-drawn material does not give the necessary formability for certain applications requiring both turning and forming. In cases where annealed rod is essential, relatively high turning speeds give best results.

In determining the rod size required for a given turning operation, allowance should be made so




**Single-point Turning Tools** suitable for beryllium copper

sufficient stock may be removed. If the initial cut is light, considerable tool wear may result from the abrasive surface scale or work-hardened layer. It is therefore advisable to have sufficient material to keep the tool buried rather than to scrape surface scale. A depth of cut of at least 0.007 in. is generally considered necessary to get under a work-hardened layer.

Work and tool should be rigidly supported. Large tools and toolholders with as little tool overhang as possible are desirable. Since the modulus of unhardened beryllium-copper rod is only abou 60% that of steel, an unsupported beryllium-copper rod will deflect considerably further for a given tool pressure than will an equivalent steel rod. Chatter may sometimes be attributed to play or lack of rigidity in the work, tool, or bearings.

**Cutting Materials** . . . High-speed-steel tools, such as 18-4-1 alloy or equivalent, are strong and resistant to shock, abrasion, and moderately high temperatures, so that these tools give good service for heavy and intermittent cuts at moderate speeds.

Carbide-tipped tools are frequent for high-production work, since they permit cutting speeds several times those for high-speed steel. When, however, the maximum cutting speeds for a given lathe are within the capacity of high-speed steel, the latter may be more economical.

Carbide tools are finding increased use because of their exceptional resistance to abrasion and ability to maintain a cutting edge over long periods at relatively high temperatures. Because carbide lacks the toughness of high-speed steel, it is essential that tools be rigidly supported with minimum overhang. This is especially true when it is necessary to take intermittent cuts. The superior resistance to tool wear offered by carbide as compared to high-speed or carbon steel insures closer control of dimensions and finish. Although lower tool wear means less down-time, at the same time it is important to keep tools sharp in order to provide best tool life and to give maximum over-all production with lowest power requirements.

In many cases the higher rate of production possible with carbide may more than offset the higher initial cost. For best results the machine should be free from play or backlash and facilities should be available for tool grinding with either silicon-carbide or diamond wheels.

## TYPICAL TOOL DESIGN FOR TURNING BERYLLIUM COPPER

| ANGLE OR RADIUS | | HIGH-SPEED STEEL | CARBIDE | REMARKS |
|---|---|---|---|---|
| Nose radius— | Rough | $\frac{1}{16}$ in. | $\frac{1}{32}$ in. | The nose radius should be held to a minimum; however, for heavy or interrupted cuts it may be necessary to increase figures given. A large radius increases the pressure between work and tool and may cause chatter. |
| | Finish | $\frac{1}{32}$ in. | $\frac{1}{64}$ in. | |
| Rake angles— | Back | 10-20° | 0° | These angles determine the chip formation. In the case of beryllium copper relatively steep rake angles are normally employed to provide an easy passage for the chip across the tool face. |
| | Side | 15-25° | 5-15° | |
| Relief angles—(clearance) | Front | 10-15° | 7-10° | Relief angles should be large enough to prevent excessive tool wear and small enough to provide adequate support for cutting edge. |
| | Side | 10-15° | 7-10° | |
| Side cutting-edge angle (lead angle) | | Approx. 15° | Approx. 15° | This angle will depend upon the individual job. When machining to a square shoulder it will of course be necessary to use a 0 angle. A lead angle of approximately 15° can generally be depended upon to give longer tool life than a smaller angle and should be used whenever possible. |
| End cutting-edge angle | | 0-15° | 0-15° | Angles in this range prove satisfactory for most rough and finish turning operations. Occasionally smaller angles are used for light finishing cuts but care should be exercised in using small angles since chatter or excessive wear may result. |

## SUGGESTED STARTING SPEEDS FOR TURNING HEAT-TREATABLE BERYLLIUM COPPER

| | 3/16-3/8 in. Cut 0.015-0.030 in. Feed | | 1/16-3/16 in. Cut 0.010-0.020 in. Feed | | 1/64-1/16 in. Cut 0.008-0.012 in. Feed | | 0.007-1/64 in. Cut 0.002 0 008 in. Feed | |
|---|---|---|---|---|---|---|---|---|
| | Speed range | Recommended starting speed | Speed range | Recommended starting speed | Speed range | Recommended starting speed | Speed range | Recommended starting speed |
| High-speed steel | 50-100 | 75 | 75-125 | 100 | 100-200 | 150 | 150-300 | 225 |
| Carbide | 125-275 | 200 | 150-350 | 250 | 200-400 | 300 | 300-600 | 450 |

**Tool Design** . . . A guide for the design of single-point turning tools is given in the table. The values listed are suggested as a possible starting point for the design of high-speed and carbide-tipped tools. Although standard tools, normally stocked by manufacturers, may not give as good service as special tools, they may prove more economical over-all.

The rake angles and clearances apply only when the tool shank is parallel to the center line of the work and the tool point is on center. If tool point is placed above or below center, particularly on small-diameter work, effective back rake and front relief angles will be changed. Therefore proper allowance must be made in grinding.

To prevent excessive wear of steel shanks of carbide-tipped tools, it is usually advisable to grind tools with a compound angle, allowing 2 to 5° more clearance for shank than required for tip.

**Speeds and Feeds** . . . It is not possible to list ranges of speeds and feeds that will apply for all beryllium-copper turning applications, because power and condition of machine, depth of cut, desired finish, tolerance, and work diameter vary from one part to another. From an economic standpoint, the most important consideration is the rate of removing metal. It is possible to remove a specific volume of metal in a given time by any number of combinations of feed, speed, and depth of cut. In turning beryllium copper, a high speed, light feed and moderate cut have been found to give best results. The speed selected, however, should be consistent with good work surface and tool life. In handling small-diameter work, speed is often limited by the maximum spindle speed of the machine.

A light to moderate feed generally aids chip disposal, because a coarse feed will produce a strong and tough chip that is difficult to handle. Such a chip will tend to abrade the work surface and will make it difficult to produce a good finish.

To insure a good finish, it is generally considered best practice in finishing to decrease the feed and increase the speed as compared to roughing cuts. For best results, feeds up to 0.004 in. and depths of cut up to 1/64 in. are used in finishing.

**Cutting Fluids** . . . Cutting fluids may be used in connection with turning operations to provide lubrication and cooling. Proper lubrication will reduce the friction between tool and work and between chip and tool face, and at the same time will carry away part of the heat generated. Some heat will of course be removed by the chip; but as best tool life is generally associated with lowest possible operating temperature, it is advisable to supply a coolant. For close-tolerance work, a coolant may prevent heating to a point at which thermal expansion affects work dimensions.

Although some jobs may be successfully turned dry, correct use of a cutting fluid will permit speed increases of as much as 25%. In addition, finer finishes and longer tool life may be obtained. For best results, a generous flow of the coolant should be supplied to the tool face and cutting edge.

For most turning operations, soluble oils are an inexpensive and suitable coolant. Solutions consisting of 10 or 30 parts water to 1 part soluble oil are usual. Although soluble oils do not provide as high a lubricating value as mineral lard oils, they offer superior cooling properties.

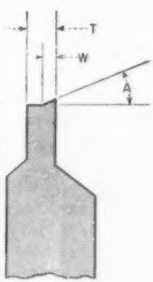
For certain critical screw-machine applications, it may be necessary to cool with sulfurized oils to obtain the required degree of lubrication, but they require special precautions (See Cutting Fluids).

## Parting Tools

High-speed steel cutoff or parting tools, either straight blade or circular, are general for beryllium copper, although carbide-tipped tools are some-

### SUGGESTED TOOL DESIGN FOR PARTING TOOLS

Back rake: 7 to 15°
Front clearance: 7 to 12°
Side clearance: 0 to 2°
W = T, when T is up to 0.060 in.
W = 1/2 T, when T is 0.070 to 0.120 in.
W = 0.060 in., when T is 0.140 in. or over
A = 23 to 25°




Thickness: Values of T for various work diameters are given in table below. But when cutting into tapped holes, T should be at least equal to 2 1/2 threads plus 0.010 in.; when cutting into reamed holes smaller than 3/16 in. dia., T should be at least 0.040 in.; when cutting tubing, T should be two-thirds of the value in the table.

| DIA. OF STOCK, IN. | T, IN. | DIA. OF STOCK, IN. | T, IN. |
|---|---|---|---|
| 1/2 | 0.020 | 7/16 | 0.090 |
| 5/16 | 0.030 | 1/2 to 9/16 | 0.100 |
| 3/8 | 0.040 | 5/8 to 3/4 | 0.120 |
| 7/16 | 0.050 | 9/16 to 1 | 0.140 |
| 1/4 | 0.060 | 1 1/16 to 1 5/16 | 0.160 |
| 5/16 | 0.070 | 1 3/8 to 1 7/8 | 0.190 |
| 3/8 | 0.080 | 2 to 2 1/2 | 0.220 |

times employed. The following rakes and clearances are suggested for straight-blade parting tools:

| | |
|---|---|
| Back rake | 7 to 15° |
| Side rake | 0 to 4° |
| Side clearance | 2 to 4° |
| End clearance | 6 to 10° |
| End cutting edge angle | 25° |

If the penetrating tool tends to bind, it may be necessary to increase end and side clearance slightly. To prevent chatter, it is essential that tools be held as rigidly as possible.

In the case of circular parting tools, the dimensions and angles will be similar to those generally used for copper alloys with several exceptions, notably increased rake and clearance angles.

For best results, high speeds and light feeds should be used with cutoff tools. The speeds given for high-speed-steel turning tools will also apply for cutoff tools, while feeds should range from 0.0005 to 0.0015 in. Cutting fluids should always be used, and those recommended for turning operations are suitable for cutoff operations as well.

## Form Tools

High-speed-steel form tools, either circular or dovetail, are recommended for beryllium copper. Carbide-tipped form tools serve for simple contours and can be depended upon to maintain close tolerances over long periods of service. A back rake of 10 to 20° together with a side rake of 3 to 4° and a front clearance of 7 to 12° will prove satisfactory for most operations with either circular or dovetail tools.

Speeds equivalent to those for turning or parting are suitable. Light feeds, in the order of 0.001 to 0.002 in. for roughing and 0.0005 to 0.001 in. for finishing, are recommended. A cutting fluid, such as mineral oil containing 3 to 7% lard oil or a sulfurized oil, is desirable.

## Shaping and Planing

As the cutting action of shaper and planer tools is similar to that of turning tools, they are also similar in design. For shaper or planer tools which must take an intermittent cut and are less rigidly supported than turning tools, a larger nose radius and a smaller rake are advisable for rough cuts. A nose radius ranging from ¼ to ⅛ in. is suggested with side and back rakes of approximately 15 and 10° respectively. Front and side relief angles of about 7° give adequate clearance. It may be necessary to alter the rake angles in order to provide proper chip disposal. Chip should coil in front of tool and break on work surface.

Because goose-necked tools permit smoother cutting than straight shank tools, they are preferred for finishing cuts. The blunt-nose tool generally

## SUGGESTED DRILLING SPEEDS AND FEEDS FOR BERYLLIUM COPPER

| ANNEALED | | | | COLD DRAWN | | | | COLD DRAWN AND HEAT-TREATED | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Drill size, in. | Speed, fpm. | rpm. | Feed per rev. | Drill size, in. | Speed, fpm. | rpm. | Feed per rev. | Drill size, in. | Speed, fpm. | rpm. | Feed per rev. |
| 1/16 | 90 | 5500 | Hand | 1/16 | 50 | 3056 | Hand | 1/16 | 30 | 1833 | Hand |
| 1/8 | 90 | 2750 | 0.002 | 1/8 | 50 | 1528 | 0.002 | 1/8 | 30 | 917 | 0.0015 |
| 3/16 | 90 | 1833 | 0.003 | 3/16 | 50 | 1019 | 0.003 | 3/16 | 30 | 611 | 0.002 |
| 1/4 | 90 | 1375 | 0.004 | 1/4 | 50 | 764 | 0.003 | 1/4 | 30 | 458 | 0.002 |
| 5/16 | 90 | 1100 | 0.005 | 5/16 | 50 | 611 | 0.005 | 5/16 | 30 | 367 | 0.003 |
| 3/8 | 90 | 917 | 0.007 | 3/8 | 50 | 509 | 0.005 | 3/8 | 30 | 306 | 0.003 |
| 7/16 | 90 | 786 | 0.009 | 7/16 | 50 | 437 | 0.005 | 7/16 | 30 | 262 | 0.003 |
| 1/2 | 90 | 688 | 0.010 | 1/2 | 50 | 382 | 0.008 | 1/2 | 30 | 229 | 0.005 |
| 5/8 | 90 | 550 | 0.014 | 5/8 | 50 | 306 | 0.008 | 5/8 | 30 | 183 | 0.005 |
| 3/4 | 90 | 458 | 0.018 | 3/4 | 50 | 255 | 0.008 | 3/4 | 30 | 153 | 0.008 |
| 7/8 | 90 | 393 | 0.020 | 7/8 | 50 | 218 | 0.008 | 7/8 | 30 | 131 | 0.008 |
| 1 | 90 | 344 | 0.025 | 1 | 50 | 191 | 0.015 | 1 | 30 | 115 | 0.010 |
| 1 1/8 | 90 | 306 | 0.025 | 1 1/8 | 50 | 170 | 0.015 | 1 1/8 | 30 | 102 | 0.010 |
| 1 1/4 | 90 | 275 | 0.025 | 1 1/4 | 50 | 153 | 0.015 | 1 1/4 | 30 | 92 | 0.010 |
| 1 3/8 | 90 | 250 | 0.025 | 1 3/8 | 50 | 139 | 0.015 | 1 3/8 | 30 | 83 | 0.010 |
| 1 1/2 | 90 | 229 | 0.025 | 1 1/2 | 50 | 127 | 0.015 | 1 1/2 | 30 | 76 | 0.010 |
| 1 5/8 | 90 | 212 | 0.025 | 1 5/8 | 50 | 117 | 0.015 | 1 5/8 | 30 | 70 | 0.010 |
| 1 3/4 | 90 | 196 | 0.025 | 1 3/4 | 50 | 109 | 0.015 | 1 3/4 | 30 | 65 | 0.010 |
| 1 7/8 | 90 | 183 | 0.025 | 1 7/8 | 50 | 102 | 0.015 | 1 7/8 | 30 | 61 | 0.010 |
| 2 | 90 | 172 | 0.025 | 2 | 50 | 95 | 0.015 | 2 | 30 | 57 | 0.010 |

requires no side rake, but is usually designed with back rakes up to 25° and with front and side relief angles of approximately 7°.

For roughing cuts speeds of 15 to 25 fpm. may be used for depths of cut ranging from 1/32 to ¼ in. and feeds from 5/64 to 3/32 in. Finishing speeds of 20 to 35 fpm. can be used for cuts up to 0.020 in. and feeds to ¼ in. Although it is not necessary to use a cutting fluid in roughing, a soluble-oil emulsion should be used in finishing.

Carbide tools give greater production, where capacity and speed of machine are adequate.

## Drilling

For applications requiring drilling, beryllium copper in the annealed condition permits higher production rates, although other considerations may compel the selection of cold-worked stock. Best results are generally obtained with high speeds and light feeds and a suitable coolant. Lower speeds are needed for cold-worked material. Although beryllium copper can be drilled in the heat-treated condition, unhardened stock should always be used for production work.

Standard high-speed-steel twist drills furnished directly from stock by drill manufacturers are satisfactory for small jobs, but production work may require special drills or specially ground standard drills. Carbon-steel drills are not recommended.

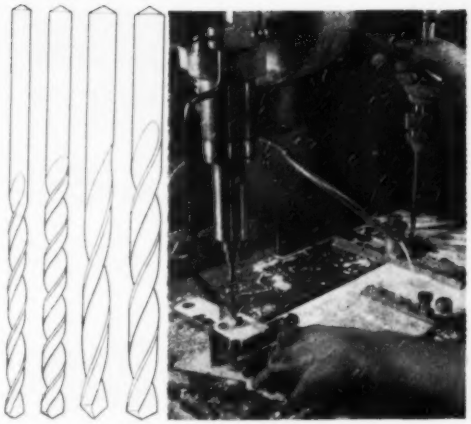
For annealed material, the standard general-purpose drill with a 26 to 30° helix angle and a 118° included angle will give good service. High-spiral drills are occasionally used for small holes but care is required in feeding to prevent hogging in. Because the standard-spiral drill is stronger and does not feed quite as easily as the high-spiral drill, it is less likely to break and is therefore generally recommended for annealed beryllium copper.

Cotter-pin drills for cold-rolled or cold-drawn tempers offer a heavier web, higher helix angle and polished flutes as compared to the standard-spiral drill. Standard drills should be used with care.

For horizontal or screw-machine work, a slow-spiral drill offers advantages in chip disposal, because the relatively straight chip produced is readily removed between operations. Straight-fluted drills are not recommended for beryllium copper.

In addition to the standard drills listed above, there are several other types available for certain applications. With oil-hole drills, which are generally available in sizes ⅜ in. and larger, it is possible to supply the coolant directly to the drill point. Similarly, a gun drill provided with an oil hole will provide needed lubrication at the point. Soluble oil forced through these drills under pressure not only helps to eject chips but also helps dissipate heat generated at the cutting edge.

Standard drills can generally be depended upon to give good service for working to depths up to two drill diameters, but it is not advisable to use standard drills for production requiring deeper holes. Standard drills on small jobs over two diameters should be backed off frequently to clear chips.



**Drills** for beryllium copper (from left): cotter-pin drill, high-spiral drill, slow-spiral drill, and standard-spiral drill; drilling cast and annealed beryllium copper parts (right) with a high-spiral, high-speed drill at 90 fpm.

When it is necessary to maintain high production rates, drills with special provisions for low heat generation and adequate chip disposal are required. Minimum friction is obtained in drill design by providing narrow margins and additional back taper and body clearance. Chip removal is aided by exceedingly smooth flutes together with a high spiral for vertical drills and a slow spiral for horizontal drills. In addition, an included angle of 140° assists in giving a flat or ribbon chip, which is easier to remove from the drill than a coiled chip. Special surface treatments provided by the manufacturer to resist wear and abrasion are also recommended.

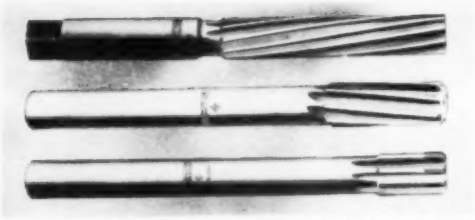
These design features are suggested for operations where a special drill offers the best answer:

| | |
|---|---|
| Included angle | 118 to 140° |
| Angle of lip clearance | 12 to 20° |
| Rake angle of lip or point | Full |
| Type of point | notched or offset |
| Margins | ½ normal width |
| Body clearance | 175 to 200% of normal |
| Back taper | 0.001 to 0.002 in. per in. |

Selection of the proper speed and feed is governed by such variables as drill sizes, depth of hole, temper of material, drillpress condition, cutting fluid, wall thickness of work, and drill type. In general, speeds and feeds decrease with increasing temper and hardness. Light feeds should also be used for small drill sizes and for accurate holes.

As power feeds are generally not used for drills ⅛ in. and smaller, a moderate hand feed is suggested for annealed stock, and a light hand feed for cold-worked material.

The average values shown in the table are intended for general use with high-speed-steel drills designed with adequate clearance, given a high polish and supplied with a suitable cutting fluid. Although the allowable depth of hole will vary with



**Reamers** for beryllium copper: top—spiral-flute hand reamer, middle—spiral-flute machine chucking reamer, bottom—carbide-tipped chucking reamer

**Spiral-fluted tap** of plug style with two flutes suitable for beryllium copper

the drill size, data apply for depths up to five times the diameter.

There are several precautions that should be observed in drilling deep holes where the depth is more than five times the hole diameter. Back taper helps to prevent binding; if binding occurs, the back taper should be increased. A suitable coolant should be supplied to remove the heat, preventing excessive thermal expansion. For soft materials, it may be necessary to increase speeds to prevent chip packing.

A cutting fluid should be used whenever possible while drilling beryllium copper. As cooling is the most important requirement, water with enough oil to prevent corrosion of tool and machine will give best results. A coolant consisting of approximately one part soluble oil to 30 parts water should be satisfactory for all applications except, perhaps, certain screw-machine operations. Where greater lubricating properties are necessary, a soluble oil having sufficient spreading action to produce a constant slippery film on the drill, allowing a smooth flow of chips through the flutes of the drill is recommended. Sulfurized or sulfur-free mineral oils are occasionally used for deep-drilling operations.

With either hand or automatic feed, it is important to keep the drill cutting. Beryllium copper, which work-hardens rapidly, will glaze and it will be difficult to resume cutting, if the drill is permitted to dwell. In this respect, particularly, care should be exercised whenever it is necessary to back off the drill to clear the hole.

## Reaming

Although many of the standard types of high-speed-steel reamers are suitable for beryllium copper, the right-hand spiral-fluted reamer gives best results. In comparison with the straight-fluted reamer, the spiral reamer is less likely to chatter and gives smoother action. A right-hand spiral should always be used, because the left-hand spiral gives not only inadequate chip disposal but also a digging cut which produces excessive heat.

For production runs, carbide-tipped reamers offer superior wear resistance. Carbide reamers should have straight, but unevenly spaced, flutes to prevent chatter. Carbide-tipped reamers must be rigidly supported.

For best results, reamers for beryllium copper should have narrow margins and adequate back taper. These angles and clearances will apply for hand and machine reamers:

**Straight or Fluted**

| | |
|---|---|
| Chamfer angle | 35 to 45° |
| Rake angle | 5 to 10° |
| Relief or clearance | 5 to 8° |
| Margin | 0.005 to 0.010 in. |
| Helix angle | 7 to 12° |
| Back taper | 0.001 to 0.002 in. per in. |

Reamers should be lapped or stoned after grinding to remove wheel marks. In addition, reamers should be kept sharp and flutes should be well polished.

Selection of the proper speed and feed for any given application will be governed by the type of reamer, finish desired, depth of hole, cutting fluid and wall thickness. In automatic screw machines, it may sometimes be necessary to ream and drill at the same speed and feed. For most applications, however, reamer speeds run about ½ to 2/3 of those used for the same size drill, while feeds run 2 to 3 times drill feeds. Speeds should be low enough to prevent wear and excessive expansion from heat.

Sufficient stock should be left for reaming to prevent burnishing, which may result in rapid wear and inaccurate work. In addition, the reamer should bite deep enough to get under the work-hardened layer left by the previous drilling or boring operation.

In order to prevent heating, a cutting fluid should always be used when reaming beryllium copper. Soluble oils are recommended on account of their superior cooling properties.

## Tapping

Standard taps for copper alloys available from stock will meet most tapping requirements. Plug

### REAMING SPEEDS AND FEEDS

| Dia. of reamer, in. | Amount to Remove on dia., in. | Feed per rev., in. | Annealed | | Cold-worked | |
|---|---|---|---|---|---|---|
| | | | sfpm. | rpm. | sfpm. | rpm. |
| 1/8 | 0.007 | 0.008 | 60 | 1833 | 40 | 1222 |
| 3/16 | 0.008 | 0.009 | 60 | 1222 | 40 | 815 |
| 1/4 | 0.009 | 0.010 | 60 | 917 | 40 | 611 |
| 3/8 | 0.010 | 0.014 | 60 | 611 | 40 | 407 |
| 1/2 | 0.011 | 0.018 | 60 | 458 | 40 | 306 |
| 5/8 | 0.012 | 0.022 | 60 | 367 | 40 | 244 |
| 3/4 | 0.014 | 0.026 | 60 | 306 | 40 | 203 |
| 1 | 0.016 | 0.032 | 60 | 229 | 40 | 153 |

taps of high-speed steel having two spiral flutes are recommended for through holes and for blind holes drilled sufficiently deep for chip clearance. In contrast with straight-fluted, the spiral-pointed, spiral-fluted taps are free cutting and clear chips from the hole, eliminating the chance of clogging grooves and damaging threads. Taps should be kept sharp to prevent rough threads and subsequent seizing.

For most applications a 75% depth of thread is sufficient, since it gives almost the same strength as a 100% thread yet requires much less power with better chip removal.

In selection of a suitable tap design for production work, it is generally advisable not to use a tap in which the cutting edge leads the center. An 8 to 15° hook or rake angle together with a short, 10 to 15° chamfer is suggested for average working conditions. A relatively short chamfer of only two or three threads will prevent overheating and excessive work hardening from too many threads being cut at the same time.

For most operations with annealed beryllium copper, tapping speeds for fine-thread plug taps will average about 50-60% of drilling speeds, giving a speed range of 45 to 60 fpm. Slower speeds should be used for coarse threads, bottoming taps, and harder tempers.

Cutting fluids are desirable for all tapping operations. Because tapping speeds are generally not fast enough to produce excessive heat, a cutting fluid should be selected for lubricating rather than cooling properties in order to prevent tap wear and to reduce power required for tapping. Mineral lard oil will give good results. Although sulfurized oils offer the best lubricating properties, they should be used with caution in order to prevent staining. White lead is occasionally used for hand tapping.

## Thread Chasing

Standard circular, tangential, and radial thread chasers of high-speed steel will thread beryllium copper. The threads of thread chasers for self-opening dieheads and tap chasers for collapsible taps should be ground and kept sharp to give longest and best service. A cutting fluid of either sulfurized or sulfur-free mineral lard oil should be used in large quantities and should be fluid enough to penetrate to cutting point of chaser.

## Milling

**Cutter Design** . . . Many of the standard types of milling cutters available for copper alloys can be used successfully with beryllium copper. Either high-speed-steel cutters or cutters having carbide inserts can be depended upon to give good service, although carbide offers higher production rates through increased cutting speeds and cutter life where machine conditions permit. It is essential, however, when milling with carbide that both machine and work be rigid.

**Design Characteristics for Thread Chasers**

| Angle | Tap or die chaser | Radial chaser |
|---|---|---|
| Rake or hook, deg. | 17-30 | 20-25 |
| Throat, deg. | 20-30 | 25 |
| Chip clearance, deg. | — | 12 |
| Face, deg. | — | 2 |

**Threading Speeds for Fine and Coarse Threads**

| DIAMETER | NATIONAL FINE | | NATIONAL COARSE | |
|---|---|---|---|---|
| | Surface speed | rpm. | Surface speed | rpm. |
| ¼ | 80 | 1222 | 70 | 1070 |
| 5/16 | 80 | 978 | 70 | 856 |
| ⅜ | 80 | 815 | 65 | 662 |
| 7/16 | 75 | 656 | 65 | 568 |
| ½ | 75 | 573 | 60 | 459 |
| 9/16 | 70 | 475 | 60 | 407 |
| ⅝ | 70 | 428 | 60 | 367 |
| ¾ | 70 | 357 | 55 | 279 |
| ⅞ | 65 | 285 | 55 | 241 |
| 1 | 65 | 258 | 55 | 210 |
| 1⅛ | 60 | 204 | 55 | 187 |
| 1¼ | 60 | 183 | 50 | 153 |
| 1½ | 60 | 153 | 50 | 127 |
| 1¾ | 55 | 120 | 50 | 109 |
| 2 | 55 | 105 | 45 | 86 |

Although beryllium copper can be readily milled in either annealed or cold-worked tempers, best results are obtained from cold-worked material. Beryllium copper should always be milled before being heat-treated.

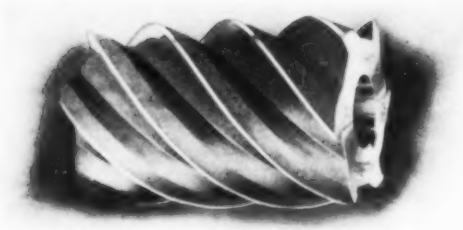
On account of the tendency of this alloy to work-harden, the cut should always be deep enough to get under the work-hardened layer. Similarly, in the case of castings or other material having surface scale, it is necessary to get under this scale to prevent excessive cutter wear.

The abrasive action of the work-hardened layer or scale can be reduced by climb milling, in which work is fed in the same direction as the movement of cutter teeth rather than against movement of teeth.

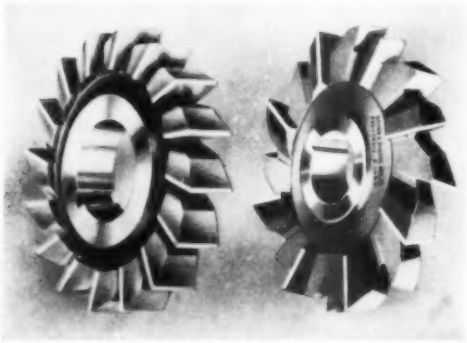
Because heat-treatable beryllium copper, like other unleaded copper alloys, is relatively ductile, chip disposal may be a problem unless a cutter having relatively coarse teeth is used. In addition to increased chip space, cutters with coarse teeth require less power and have less tendency to chatter than those having fine teeth.

The selection of the best cutter for a specific job often depends upon available equipment. A helical plain mill is recommended for slab milling, while a staggered-tooth mill generally gives better results for slotting than either side or half-side cutters. Face-milling cutters with carbide or high-speed-steel inserts are finding increased use by virtue of their versatility.

In order to prevent excessive friction and at the same time obtain the proper cutting action it is nec-



**Helical, plain milling cutter** for slabbing cuts



**Side-milling cutters** (left) are used in pairs as straddle mills for sizing; staggered-tooth side-milling cutter (right) is preferable to side mills for slotting operations

essary to: (1) provide adequate relief or clearance and (2) maintain relatively narrow lands. The relief which is the angle between land and tangent at tip should be great enough to prevent rubbing between work and land. For beryllium copper, this angle ranges from 4 to 15°, depending upon feed, helix angle, and cutter diameter. Larger relief angles are required for heavy feeds and large helix angles. Cutters under ⅜-in. dia. may require clearance angles as great as 10 to 15°, while a relief of 4 to 6° may serve for cutters 3 in. and up.

For best results, the cutting edge should not lead center, so that either a zero or positive radial rake should be used. A positive rake is recommended, as rakes of 10 to 15° require less power than radial teeth and frequently give freer cutting and a better finish.

The following design features for various types of cutters are suggested for heat-treatable beryllium copper. Since the designs listed cover average conditions, allowances should be made for type and shape of work, cutter material, and condition of machine.

**Plain Mills** . . . Plain mills having helical teeth are recommended for slab milling beryllium copper. A cutter having a large helix angle, such as 40-50° is generally desirable since it offers increased tooth strength through fewer teeth, smoother action through longer tooth contact and reduced tendency to chatter, as compared to cutters having a small helix angle or straight teeth.

In addition, the helical mill is preferred over the old type coarse-tooth cutter because it gives smoother action, finer finish, and at the same time requires less power.

These design features are suggested for high-speed-steel helical plain cutters.

| | |
|---|---|
| Relief or clearance angle | 4 to 6° |
| Secondary clearance angle | 45° |
| Rake angle | 10 to 15° |
| Helix angle | 40 to 50° |
| Land | 0.015 to 0.030 in. |

**Side Mill** . . . The side mill has straight teeth on the circumferential surface and on both sides extending part of the distance from circumference toward the axis. A half-side mill has teeth on only one side.

Although these mills are frequently used for slotting, staggered tooth mills are preferred on account of greater freedom from chatter and higher rates of production.

The following design angles apply for high-speed-steel side and half-side mills:

| | |
|---|---|
| Relief or clearance angle | 4 to 7° |
| Secondary clearance angle | 45° |
| Rake angle | 0 to 15° |
| Side clearance angle | 12° |
| Side relief angle | 2 to 5° |
| Concave relief angle | ½° |

**Staggered Tooth Mill** . . . This mill has teeth of alternating right- and left-hand helix angles for cutting edges around circumference of cutters and is recommended for either deep, shallow, or varying-depth slots. These cutters can take a deep cut with a good finish and without excessive chatter or vibration. Increased speeds and feeds made possible by the free-cutting action give increased production.

Standard staggered-tooth cutters as supplied from stock, generally have sufficient axial and radial rake to give a good cutting action with beryllium copper. A positive rake of at least 10° in both radial and axial directions is recommended.

**Face Mill** . . . Cutters with inserted teeth are suitable for all classes of face milling. Angles for face

**Angles for Inserted-Tooth Face Mills**

| | High-speed steel deg. | Carbide deg. |
|---|---|---|
| Peripheral relief or clearance angle | 4-7 | 4-7 |
| Positive radial or face rake angle | 10-15 | 3-8 |
| Positive axial rake angle | 10-15 | 0-3 |
| Concave relief angle | 2-4 | 2-4 |
| Face relief angle | 2-7 | 2-7 |
| Chamfer or bevel angle | 15* | 15* |

*For shoulder cutting must be 0°

mills with either carbide or high-speed-steel inserts are given in a table.

Angles listed for face milling will also apply for fly-cutting with carbide or high-speed-steel inserts.

**End Mill** . . . For best results with beryllium copper, an end mill should have helical or spiral teeth. A spiral end mill having four teeth and a steep helix angle will meet most end-milling requirements. Positive rake offers increased production with reduced power requirements, while the steep helix provides a smooth cutting action. As in the case of other classes of milling cutters, it is important to have adequate chip space between teeth.

For applications requiring a high degree of accuracy, spiral end mills with two teeth are recommended. These mills should have a small helix angle, hollow faces, positive rake, and generally require high surface speeds for best results.

**Feeds and Speeds** . . . As in the case of other machining operations, it is not possible to give speeds and feeds that will hold for all operations. In milling these values are subject to such variables as size and material of cutter, size and temper of work, depth of cut, finish, cutting fluid, power available, and rigidity of fixture, work, arbor, cutter, and machine.

In order to obtain maximum production, a combination of speed and feed should be selected to remove the maximum volume of metal per cutter grind consistent with finish desired and condition of machine.

The work finish depends upon the spacing of the cutter marks. These marks are dependent upon the feed per revolution, so the feed will be determined by the finish required. Cutter marks for a fine finish may range from 1/64 to 1/16 in., and the feed per tooth and table feed may be determined as follows:

$F_t$ = feed of work in inches per cutter tooth.
$F_r$ = feed of work in inches per cutter revolution.
$F_m$ = feed of work in inches per minute.
rpm. = cutter revolutions per minute.
N = number of cutter teeth.
$F_t \times N \times rpm. = F_r \times rpm. = f_m$

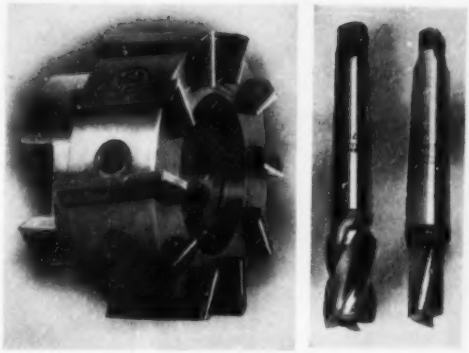
### Milling Heat-Treatable Beryllium Copper

**Speeds**

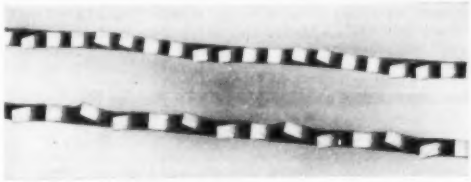
| Tool material | Depth of cut in in. Over 1/16 fpm. | 1/64—1/16 fpm. | Under 1/64 fpm. |
|---|---|---|---|
| High-speed steel | 100-150 | 150-200 | 200-300 |
| Carbide | 200-400 | 300-600 | 500-900 |

**Feeds**

| Type of Cutter | Depth of cut in in. Over 1/16 in. per tooth | 1/64—1/16 in. per tooth | Under 1/64 in. per tooth |
|---|---|---|---|
| Plain helical mill | 0.010-0.015 | 0.015-0.020 | 0.008-0.012 |
| Side mill | 0.012-0.025 | 0.016-0.030 | 0.008-0.015 |
| Face mill | 0.012-0.025 | 0.016-0.030 | 0.008-0.015 |
| Staggered-tooth mill | 0.008-0.014 | 0.014-0.018 | 0.006-0.010 |
| End mill | 0.007-0.012 | 0.010-0.015 | 0.005-0.010 |



**Face-milling cutter** (left) with alloy-steel body can be supplied with either high-speed or carbide-tipped inserted teeth. End mills (right) include spiral end mill with steep helix angle (left) which is suitable for most end-milling requirements and two-lipped spiral end mill with small helix for slotting with extreme accuracy



**Hacksaw blades** with wavy-set teeth (top) are for sawing thin strip or thin-walled tubing. Regular-set blades are suitable for most other sawing operations

*Required:* finish with cutter marks spaced approximately 0.031 (1/32) in. apart for an 8-tooth cutter rotating 100 rpm.

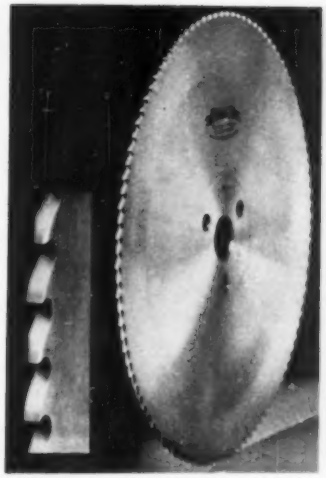
*Then:* $F_t = \frac{F_r}{N} = \frac{0.031}{8} =$ approx. 0.004 in. per tooth.

$F_m = F_r \times rpm. = 0.031 \times 100 = 3.1$ ipm.

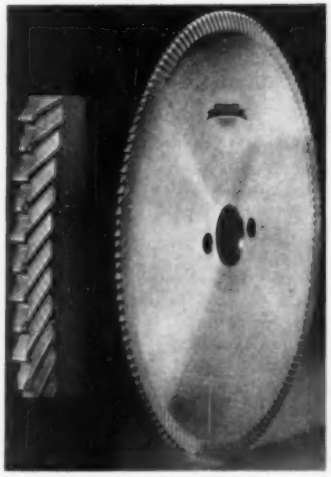
**Cutting Fluids** . . . A cutting fluid is recommended for milling beryllium copper only when the required finish cannot be obtained by cutting dry or when a coolant may be necessary. Emulsions consisting of water and soluble oil are general. For cooling, an emulsion having one part soluble oil to 10 to 30 parts water is suggested. The finish may be improved by increasing the percentage of oil or by using mineral oils with lard oil additions. Although the best finishes are obtained from sulfurized oils, these oils should only be used with caution in order to prevent staining. Cutting fluids are generally used when milling with carbide.

## Sawing

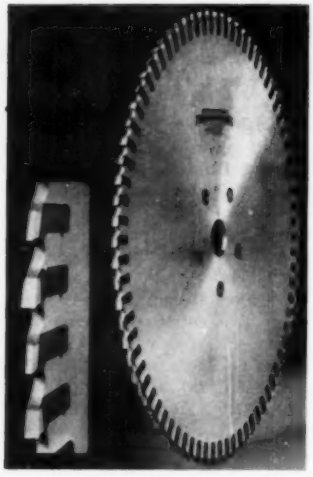
**Hacksaws** . . . For odd jobs, hacksaws set up for handling steel will generally prove satisfactory, but for production work it is generally advisable to



**Solid-type cold saw** of semi-high-speed steel has formed teeth, with every other tooth higher and beveled on both sides



**Segmental-type cold saw** with high-speed-steel segments has tooth design similar to that in the solid saw



**Inserted-tooth cold saw** with high-speed-steel inserts. This saw is suitable for heavy stock but does not give as fine a finish as the segmental type

### Recommendations for Hand and Power Hacksaws

| | TYPE OF SAW | | | |
|---|---|---|---|---|
| | HAND | | POWER | |
| | General use | Thin strip or tubing | Light machine | Heavy machine |
| Number of teeth | 14-18 | 24-32 | 10-14 | 6-10 |
| Blade thickness, in. | 0.025 | 0.025 | 0.032-0.065 | 0.065-0.072 |
| Blade width, in. | ½ | ½ | ⅝-1 | 1¼-1½ |
| Blade length, in. | 10-12 | 10-12 | 12-18 | 12-24 |
| Speed, strokes per min. | — | — | 50-60 | 90-120 |

### Sawing Speeds for Heat-Treatable Beryllium Copper

| SAW TYPE | TOOTH TYPE | TOOTH MATERIAL | PERIPHERAL SPEED, fpm. |
|---|---|---|---|
| Slitting | Various types of beveled | HSS | 40-100 |
| Solid cold | Alternate beveled and flat | Semi-HSS | 40 |
| Inserted tooth | Alternate beveled and flat | HSS | 40-60 |
| Segmental | Alternate beveled and flat | HSS | 40-120 |
| Screw slotter | Regular | HSS | 450-600 |

### Minimum Cutting Radii for Band-Saw Blades

| | | | | | |
|---|---|---|---|---|---|
| Band width, in. | ½ | ¾ | 1 | 1¼ | 1½ |
| Minimum radius, in. | 3 | 1¼ | ⅝ | ¾ | ⅞ |

### Band-Sawing Speeds for Heat-Treatable Beryllium Copper

| BLADE TYPE | TEETH PER IN.* | SPEED, fpm |
|---|---|---|
| Regular | 10-14* | 150-200 |
| Skip tooth | 3-6* | 150-200 |

*Use lower values for thick materials

select blades suited for sawing beryllium copper.

High-speed-steel blades normally used for brass, bronze, or copper are suitable for sawing heat-treatable beryllium copper. These blades have a regular set and are coarse-toothed to reduce friction and provide adequate chip clearance. Large gullets enable chips to form without danger of clogging. In sawing thin stock or thin-walled tubing, however, it may be necessary to use a blade with fine teeth and wavy set to insure proper tooth action and to prevent straddling. Two or more teeth should always be in contact with the work.

For best results with hand hacksaws, use a relatively slow stroke (less than 50 strokes per minute) and apply some pressure against work. When using either hand or power saws, it is important to furnish sufficient pressure to keep saw cutting.

**Metal Slitting Saws** . . . Metal slitting saws are used for cutting strip and bar stock to required widths and for moderate slotting operations. Screw slotters are recommended for shallow slots, while staggered-tooth milling cutters are preferred for deep slots. Cold saws are used for cutting rod and bar stock to length.

High-speed-steel slitting saws having 5 to 7° clearance on the periphery and a 10 to 13° rake or hook are recommended. In addition, saws are generally hollow ground so that only the cutting surface contacts work. Slitting saws which are available with various combinations of beveled teeth are preferred.

Circular cold saws are supplied in three types: (1) solid tooth, (2) inserted tooth, and (3) segmental. When the solid-tooth types are selected, saws of semi-high-speed steel having formed teeth are recommended. Saws having every other tooth

0.012 in. higher and beveled on both sides with square teeth between give better results than saws having all square teeth. The spacing of teeth is determined by the thickness of stock being cut, since two teeth should be in the cut at all times. It is, however, advisable to use a saw with coarse teeth whenever possible, because the greater gullet space provided by well-spaced teeth offers added chip space. In addition coarse teeth are stronger and generate less friction. In order to provide the proper cutting action, the saw should have a 5 to 7° clearance along the periphery, a 10 to 13° rake or hook and adequate side clearance.

Inserted-tooth saws having high-speed-steel inserts in a carbon-steel plate are general for cutting relatively heavy stock. For best results, teeth should be inserted so that every other tooth is beveled on top and is narrower and slightly higher than the alternate flat-topped teeth. Teeth are generally provided with side clearance, 10 to 13° peripheral clearance and 10 to 15° hook or rake.

Segmental saws have high-speed-steel cutting segments containing several teeth riveted to an alloy-steel plate. This type of saw is generally used where a smooth cut is required for thin materials, or where higher speeds and a narrower kerf are necessary in cutting heavy stock. Higher cutting speeds are obtainable with this type saw as compared to either solid or inserted-tooth saws. The hook and clearances of the segmental saw are similar to those used with the inserted-tooth type; however, the tooth shape varies in that segmental teeth

## GRINDING WHEEL CHARACTERISTICS FOR BERYLLIUM COPPER

| CLASS OF WORK | | MATERIAL TEMPER | ABRASIVE | GRAIN SIZE | GRADE | STRUCTURE | BOND | SPEED, fpm. |
|---|---|---|---|---|---|---|---|---|
| Cylindrical—between centers | | Annealed | Silicon carbide | 36 | K | Medium | Vitrified | 5500-6500 |
| | | Cold-drawn | Silicon carbide | 36 | K | Medium | Vitrified | 5500-6500 |
| | | Heat-treated | Aluminum oxide | 36 | L | Medium | Vitrified | 5500-6500 |
| Cylindrical—centerless | | Annealed | Silicon carbide | 36 | N | Medium | Vitrified | 5500-6500 |
| | | Cold-drawn | Silicon carbide | 36 | N | Medium | Vitrified | 5500-6500 |
| | | Heat-treated | Aluminum oxide | 60 | N | Medium | Vitrified | 5500-6500 |
| Surface | | Annealed | Silicon carbide | 24 | H | Medium | Vitrified | 5500-6500 |
| | | Cold-drawn | Silicon carbide | 24 | H | Medium | Vitrified | 5500-6500 |
| | | Heat treated | Aluminum oxide* | 60 | H | Open | Vitrified | 5500-6500 |
| Internal | | Annealed | Silicon carbide | 36 | K | Medium | Vitrified | 4500-5500 |
| | | Cold drawn | Silicon carbide | 36 | K | Medium | Vitrified | 4500-5500 |
| | | Heat-treated | Aluminum oxide | 60 | K | Medium | Vitrified | 4500-5500 |
| Snagging (off-hand) | low speed | Annealed | Silicon carbide | 24 | Q | Medium | Vitrified | 5500-6500 |
| | | Cold-drawn | Silicon carbide | 24 | Q | Medium | Vitrified | 5500-6500 |
| | | Heat-treated | Aluminum oxide | 20 | Q | Medium | Vitrified | 5500-6500 |
| | high speed | Annealed | Silicon carbide | 24 | P | Medium | Vitrified | 8000-9500 |
| | | Cold-drawn | Silicon carbide | 24 | P | Medium | Vitrified | 8000-9500 |
| | | Heat-treated | Aluminum oxide | 24 | N | Medium | Vitrified | 8000-9500 |
| Snagging (swing frame) | low speed | Annealed | Silicon carbide | 14 | Q | Medium | Vitrified | 5500-6500 |
| | | Cold-drawn | Silicon carbide | 14 | Q | Medium | Vitrified | 5500-6500 |
| | | Heat-treated | Aluminum oxide | 12 | Q | Medium | Vitrified | 5500-6500 |
| | high speed | Annealed | Silicon carbide | 14 | R | Medium | Vitrified | 8000-9500 |
| | | Cold-drawn | Silicon carbide | 14 | R | Medium | Vitrified | 8000-9500 |
| | | Heat-treated | Aluminum oxide | 14 | P | Medium | Vitrified | 8000-9500 |
| Cutting-off (misc.) | wet | Annealed | Aluminum oxide | 20 | R | Medium | Rubber | 7500-15,000** |
| | | Cold-drawn | Aluminum oxide | 20 | R | Medium | Rubber | 7500-15,000** |
| | | Heat-treated | Aluminum oxide | 20 | R | Medium | Rubber | 7500-15,000** |
| | dry | Annealed | Aluminum oxide | 20 | R | Medium | Resinoid | 7500-15,000** |
| | | Cold-drawn | Aluminum oxide | 20 | R | Medium | Resinoid | 7500-15,000** |
| | | Heat-treated | Aluminum oxide | 20 | R | Medium | Resinoid | 7500-15,000** |
| Cutting-off (tubing) | wet | Annealed | Aluminum oxide | 150 | R | Medium | Rubber | 7500-15,000** |
| | | Cold-drawn | Aluminum oxide | 150 | R | Medium | Rubber | 7500-15,000** |
| | | Heat-treated | Aluminum oxide | 150 | R | Medium | Rubber | 7500-15,000** |
| | dry | Annealed | Aluminum oxide | 150 | R | Medium | Resinoid | 7500-15,000** |
| | | Cold-drawn | Aluminum oxide | 150 | R | Medium | Resinoid | 7500-15,000** |
| | | Heat-treated | Aluminum oxide | 150 | R | Medium | Resinoid | 7500-15,000** |

*Fragile Type.

**Depends upon rigidity of machine and wheel size.
Cutoff wheels larger than 16 in. dia.: 7500-14,000 fpm.
Cutoff wheels up to and including 16 in. diameter: 10,000-15,000 fpm.

have a well-rounded gullet which gives better chip action. Because of the higher cutting speeds and superior cutting action, inserted tooth or segmental saws are preferred over solid cold saws for production work.

In setting up for cutting with circular cold saws it is suggested that work be set and fed as close as possible to center of saw, so that the chip thickness will approach a maximum. By doing this, whenever possible, tooth life will be increased, because the saw will tend to get under scale or work-hardened layer rather than rub along the surface.

Screw slotters which are used for slotting screw heads necessarily have fine teeth, so that the pitch will not exceed the diameter of screw head. High-speed-steel slotters with zero rake or hook and no side clearance give good results on beryllium copper.

Use of a cutting oil whenever possible increases saw life and cutting speed. The oil stream should play on saw teeth just before they enter the cut. A good coolant, such as an emulsion of one part soluble oil to 25 parts water, will help keep saw and work cool.

Abrasive cutoff wheels are covered in the section on Grinding.

**Band Saws** . . . Band saws are used for straight and contour sawing of beryllium strip, bar, and rod and also for removing gates and risers from castings. A hard-edge band of either regular or skip tooth types is recommended. The hard-edge band with raker-set teeth is generally used for thin materials, while the buttress or skip tooth band is used for material ¼ in. and above in thickness. The buttress band is similar to the regular band except that every other tooth is removed to give the added chip clearance required in sawing beryllium copper. When teeth are too fine, chips quickly pack between teeth preventing proper cutting.

In sawing thin materials, fine-tooth bands are necessary to prevent teeth from straddling the work. A band should be selected with a pitch that insures that at least two teeth are cutting at all times. For cutting thin-walled tubing or thin strip stock, saws having fine teeth with a wave set are recommended in order to prevent stripping of teeth.

It is important that sufficient feeding pressure be maintained so that the saw is always cutting and not rubbing the work, otherwise beryllium copper will work-harden leaving a hard, glazed surface. In addition, dull saws cause work hardening, so that the band should be replaced as soon as teeth show wear.

In a manner similar to other machining operations, the correct band speed is dependent upon several variables. The thicker the material or the higher the temper or hardness, the slower the speed. When a number of sheets are stacked for contour sawing, the stack thickness will determine pitch and speed. For best practice, it is suggested that a speed near the bottom of the ranges listed in the table be selected as a starting point, and that these initial speeds be increased when possible.

Coolants such as emulsions of soluble oils are sometimes used in order to increase cutting speeds, while for some applications a cutting fluid may be necessary to prevent adhesion of metal to tooth point. Saw manufacturers or cutting-oil representatives should be consulted regarding proper cutting fluid and method of application.

## Grinding

The selection of a grinding wheel for beryllium copper will be influenced by a number of variable factors. The size, shape and nature of work together with the amount of stock to be removed, accuracy, and finish required, will determine the type of grinding operation.

The next step is to consider such variables as temper of material to be ground, condition of grinding machine, arc of contact, and whether grinding will be wet or dry. Finally, each of the following wheel characteristics must be determined in order to obtain best results for a given job:

1. Kind of abrasive
2. Grain size
3. Grade (hardness)
4. Structure (open or dense)
5. Bond type

Because the problem of selecting the best wheel for a given job is complicated by many variables as indicated above, it is generally advisable to contact a wheel-manufacturer's representative whenever grinding problems arise. The following recommendations are, therefore, of a general nature.

Since beryllium copper may be readily ground in any condition or temper, parts are generally finish ground after heat-treating. When other machining operations such as turning or milling precede finish grinding, parts should be machined, heat-treated and then ground. Rough grinding operations such as snagging or cutting-off usually precede the hardening heat-treatment.

In selecting a suitable speed for a given grinding operation, it should be remembered that too slow a speed will cause rapid wheel wear while too high a speed may burn work or load wheel face with material being cut.

Cutting fluids should be used whenever possible, since wet grinding not only prolongs wheel life but also gives a better finish as compared with dry grinding. Since the principal function of the cutting fluid is to dissipate heat, emulsions of the order of 30 to 80 parts water to 1 part soluble oil are generally preferred.

***We acknowledge*** . . . *the assistance given by the following firms in providing data for this report:*

American Non-Gran Bronze Co.
E. C. Atkins and Co.
Brown & Sharpe Mfg. Co.
Carboloy Co., Inc.
The Carborundum Co.
The Cleveland Twist Drill Co.
The DoAll Co.
Esso Standard Oil Co. of Pennsylvania
Gulf Oil Corp.
Kennametal Inc.
Morse Twist Drill and Machine Co.
W. T. Peterson Co.
Simonds Saw and Steel Co.

# ROUND TABLE

## Is Business, Business?

"Well, Ed, here it is!" said Al, as he dropped an order on the desk. "I was afraid of this, ever since orders began to drop off."

"This is too bad," replied Ed. "Things were going along so good in your department, too. But business is business—we ain't running a charity. Got any ideas as to who you're going to let out?"

"That's just what I dropped in to see you about. You either give me an idea that's worth something, Ed, or else you make me so mad with your bullheadedness that my own brain gets to functioning better as a consequence."

"Thanks, Pal! Them's fightin' words," smiled Ed. "I still want to know who you're going to let go."

"There's not a man in my department whom I want to get rid of, Ed," returned Al. "They're all good. I can't quite make up my mind which of two men to lay off—Thomas or Smith."

"Shouldn't be any difficulty there, Al," said Ed. "Seniority should help you decide that easy enough."

"Thomas hasn't been here so very long, but, besides being a good worker he's pretty social-minded," volunteered Al. "The man has a very fine family, is a member of the Lookup Church over in Lakeview, and is very active in the Boy Scouts."

"What's that got to do with our business? Surely you wouldn't keep him on instead of Smith. Smith's been here six months longer than Thomas!"

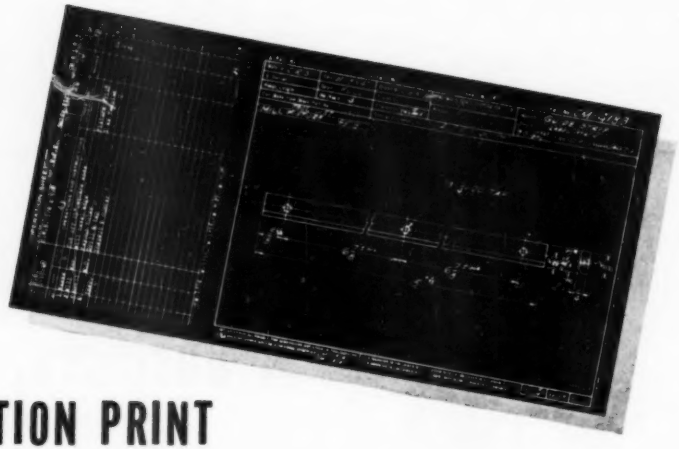
"Suppose he has, Ed," argued Al. "Just what does Smith do for the community but increase some guy's profits on a little liquor—mind you now, I like the fellow and all that, but I'm just putting a few things to you for the sake of argument. He doesn't have any family, doesn't help the town, doesn't contribute to any church—all he has to think about is himself."

"That isn't the point," insisted Ed. "We're running a shop here, Man, and it's what a fellow does and how he does it that counts—not outside effort."

"I can't follow you on that, Ed," came back Al. "I think that we, as employers of labor, have as much interest in the community as anybody else and should take that into consideration when a time like this comes."

"I don't agree with you, Al," insisted Ed. "Business is business—cold-blooded though it is—it's entirely separate from sentimentalities."

***WHEN HARD TIMES COME,*** *what should govern—seniority or sentiment? Is a man's business outside working hours his own? Your ideas and opinions on this question will interest others. Discussions of earlier topics appear on later pages.*



# PRODUCTION PRINT CORRELATES ORDER, DRAWING AND OPERATIONS

BY J. B. SAVITS, Methods Engineer, Pneumatic Scale Corp.

WORK orders at Pneumatic Scale Corp. are started at the production-control office, which calls for three components before the order can be released to the shop. Methods engineering provides a current operation sheet for the part ordered; production adds a part tracing; and finally a production and inspection record is added. Physically, the complete records are in one piece. The operations sheet, printed on paper that will blueprint, is printed beside the part tracing so the two will produce a slightly elongated print. The back of the operations-sheet section is rubber-stamped with the production and inspection form, which will be filled out during production of the work.

As the parts move through production, routed by the operations sheet and controlled by the drawing, data is added in the shop to the production and inspection form. The final inspector closes out the order, delivers the completed parts to the storeroom, and the print is detached from the other form. Production control and cost departments receive the filled-in form as notice that the order is completed, and the print is dis-

**Work-order form** (right) is rubber-stamped on back of operation-sheet print to identify order number, date and quantity and to record operations

**Master operation sheet** printed on 8x5-in. light banknote paper is blueprinted along with part drawing. Standard data is typed in, and variables are added in pencil. Combination correlates the two until after inspection when they are separated, operation sheet is kept as record

OPERATION SHEET — MATERIAL: C.R.S. 1/4 x 5/8 — B.P.M. — Guide Strip — CM-4 1 8 3 — J.S. 2-10-48 — TOTAL: 26 — WEIGHT: 14 — QTY: 20

| OPER. NO. | DEPT | TYPE OF MACHINE | OPERATIONS AND INSTRUCTIONS | TOOLS USED (GIVEN BY FOREMAN) | REMARKS | STANDARD TIME SET-UP | STANDARD TIME PIECE |
|---|---|---|---|---|---|---|---|
| 1 | | Hacks | Cut off .15" square ends | | | 50. | 8.3 |
| 2 | Mill | Hor. | Mill bevel edge | Fixture #9519 | | 15. | - |
| 3 | Drill | | Layout holes | as Templet | | 18. | 5.5 |
| 4 | | S.D. | Drill & tap | | | | |
| | Insp. | | Inspect & number | | | | |
| | | | | | | 83. | 138 |

REFERENCES: CM-1314, CM-1315, CM-1316, CM-3527, CM-3528

CHARGE TIME & MATERIAL TO CM-4180

| DATE ORDERED | | | QUANTITY | | |
|---|---|---|---|---|---|
| 9-9-48 | | | 20 | | |
| GOOD PIECES | DEPT. | OPER. | MAN NO. | DEFECTIVE | INSP. BY |
| 20 | R | 1 | 983 | 0 | 789 |
| 20 | M | 2 | 849 | 0 | 721 |
| 20 | D | 3 | 611 | 0 | 793 |
| 20 | | 4 | 624 | 0 | 793 |

SPLITS: DATE | FOUND | BY

CLOSING NOTICE: PCS. DEL'D 20; BY 624; INSPECTOR 793; DATE CLOSED 10-11-48; REV. DEPT. 10-13-48; LOCATION IN STORES 57-YY

carded. A paramount advantage of this method is that only one print of the part is issued with each order, and therefore no duplication of work is possible.

Operations sheets, prepared by methods engineers with time allowances provided by time study, include a list of all operations and their descriptions, and a routing, in proper sequence, through the necessary departments. Operation descriptions, tool numbers and time allowances are complemented by an unusual feature: a list of similar parts, by serial number, on the bottom of the sheet.

Besides acting as a tracing for production orders, the master sheet is printed, when new, in two copies. One goes to the cost department to help them predetermine costs for that part, and the other is filed with the master in the production-control office. The master itself is used over again until either the process changes or a new design is adopted.

The system provides each worker with the adequate data on the part he must produce, and dictates that it must be made in a standard manner. However, the print form invites suggestions for improvement, which are filed with the master sheet until a revised sheet is made. With this method, manufacturing is rapid and efficient, and paper work is kept to a minimum.

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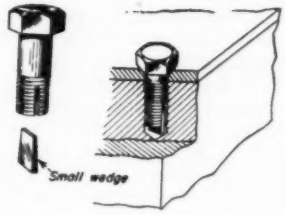
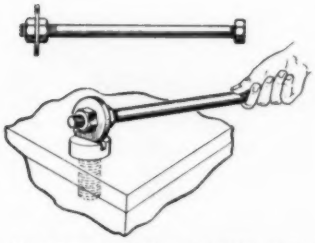
# *Short Cuts* FOR THE SMALL SHOP

BY A. H. WAYCHOFF

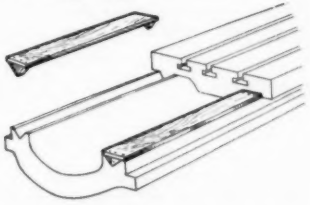



SCREWS WILL HOLD in worn threads in castings if the screw body is expanded. Saw a slot lengthwise in the screw or stud, spread with a chisel point or drive in a small wedge, as you see fit. If the wedge is used, it will be forced up into the slot in the screw when the latter is about to bottom in the hole.

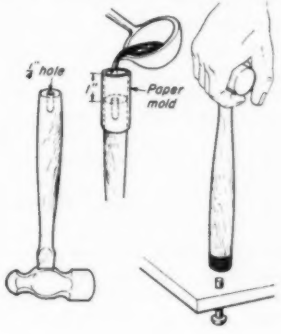


OFFSET SCREWDRIVERS of heavy type are often needed for removing large slotted-head screws in hard-to-reach locations. A useful tool can be made by placing a large washer between two nuts on one end of a long machine bolt. Of course, the washer should be ground down to fit the screw slot.

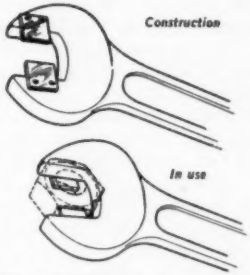
DUST PROTECTORS for planer ways keep out dust and grit while the machine is idle. To make them, fasten triangular wooden blocks to the ends of a slat that will cover the V-opening.



A LEAD END on a hammer handle may prove useful when tapping out screws, pins, etc. Drill a ¼-in. hole in the end of the handle. Wrap several turns of heavy paper around the end. Then pour in babbitt and dress the face. When the babbitt becomes mashed down, it is easy to pull it out and pour another.

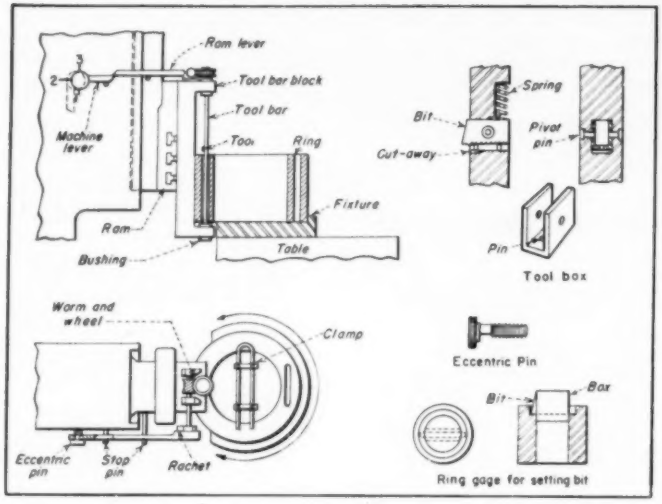


UNWINDING OF SPOOLS of belt lacing, packing, cords, electric wire can be prevented with this simple device. Cut off a portion of one leg of a cotter pin; sharpen the other leg to a small rounded point. Put the eye of the cotter pin over the end of the material and push the pointed end into the coils on the spool. Now the material will not unwind, and the device will help in locating the end of the material.




NUT HOLDERS on wrench jaws are helpful in starting a nut in an awkward place. Take two small pieces of sheet metal and fasten them to the wrench jaws to form a small ledge upon which the nut can be placed.

# Practical Ideas




## Toolbar Rig Machines Out Long, Thin Slots

TWO SLOTS lengthwise through the shell of a large, cast-iron ring were slotted with a special rig that may be interesting to machinists. After the ring had been machined all over on the outside, it was set up in a dish-type locating fixture on the machine table and clamped so as to overhang the table edge slightly. One cored slot was located under the ram and the toolbar was installed.

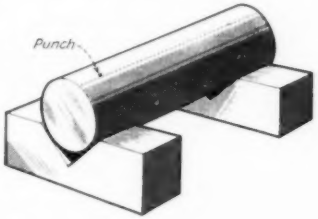
To reduce spring in the toolbar, it was held by a special yoke or block bolted into the T-slots in the ram. Two sets of bushings were used between the bar and the block—one for the light roughing bar that cut the cored holes from the cast ¾-in. width out to about 15/16 in., and one for the finishing bar, which was heavier for a more accurate cut, to complete the slots to their 1-in. size.

Mounted on top of the block were a worm and wheel and a ratchet. These components produced the rounded ends inside the slots. With the table held stationary, a stroke of the ram brought down a ram lever against a machine lever which was held in a horizontal position by a pin. This lever forced the ram lever up as the ram descended, which acted through the ratchet to turn the worm, the gear and the toolbar. With this arrangement, the bit turned around the end of the slot slowly as the ram continued reciprocating.

For the straight sides, the table was engaged and the worm and ratchet were disengaged by flipping the machine lever over to the vertical (dotted line) position where it could not act. The pivot for this lever was a pin with a section cut eccentrically around its axis. The knurled knob was marked with an index line, which could be turned to the numbers marked on the machine. These indicated positions at which the eccentric pin would extend the machine lever horizontally toward the ram lever. Thus, the number three position indicated that the levers would overlap enough to make the worm turn over three gear teeth—for a rapid roughing cut—and the number one indicated a slower rate of turn for the finishing cut. Since the more the levers overlapped the higher the ram lever would be forced, this would turn the toolbar and the bit most rapidly per stroke as the ram reciprocated.

The toolbit was mounted inside a three-sided box in a slot in the toolbar. The bottom of the bit was serrated regularly with a 0.03-in. pitch, and these serrations caught on two pins with coned tips sunk in the bottom of the box. This held the bit securely in a pre-set location. A spring mounted in the slot backed the tool and box, which could rock in the slot because of undercuts in front and back.

Regrinding was gaged with a ring that admitted the box and bit, forming a standard radius to which the tool was ground. *C. D. Mackinnon, Lanarkshire, Scotland.*

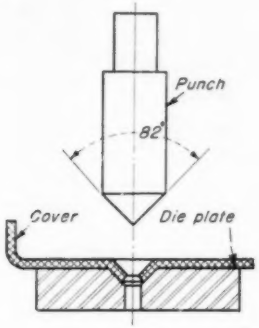


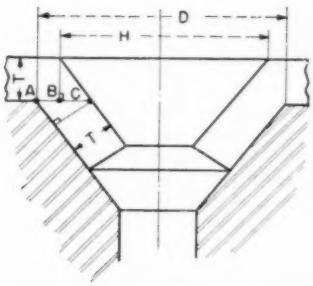

### Light Lines Locate Scribing Lines

DRILL LOCATIONS and scribing lines can be located on round shafting parallel to the axis by placing the shaft on a table in a strong beam of light. The shadow made by the light from a low source makes a

line that can be scribed with ease. Centerpunch marks can also be made along the line for drilling a number of holes parallel.

The light source must be strong, and the shaft must be polished or smoothly finished for the line to be accurate and clear. *Leonard Mills, Loveland, Col.*




## Countersunk Plate and Punch Form Flat-Head-Screw Dimple

SPUN-ALUMINUM COVERS we recently produced were to have no projection inside the cover under the plastic handle on top. Since the quantity ordered was too small to justify a regular punch and die, we made up a simple outfit that would form a dimple for a flat-head screw at a low cost.

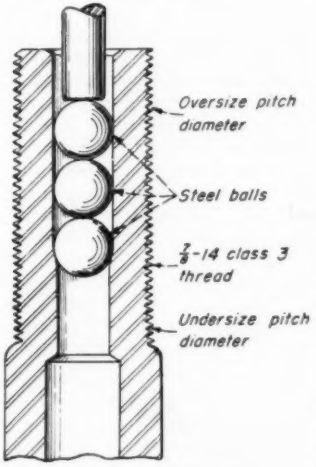
A 3-in. length of ¾-in. drill rod was turned at one end to an 82° included-angle point, the angle of the screw head. A ½-in. diameter was turned on the other end to form a shoulder to take thrust from the drillpress chuck, where the rod was chucked as a punch. Because the material was soft, this was enough shoulder to take the force, and the punch did not have to be hardened.

A ½-in. steel plate was then clamped to the drillpress table, drilled with a 1/16-in. drill and countersunk at the head angle. The width of the countersink at the top of the hole was determined by:

$$D = H + 2\,\overline{AB}$$
$$= H + 2\,(\overline{AC} - \overline{BC})$$
$$= H + 2\,\left(\frac{T}{\text{Cos } 4.1^\circ} \text{ TxTan } 41^\circ\right)$$

To prevent tearing, the edge of the hole was chamfered about 1/64 in. with a ½-in. drill point. The hole drilled in the cover, after a few trials, was standardized at a No. 47 drill, which passed a No. 8 screw.

Because the setup was made directly on the drillpress that drilled the hole, the punch was self-centering. The plate was not hardened, although it would have been for a tougher cover material. *S. D. Yarm, Brooklyn, N. Y.*

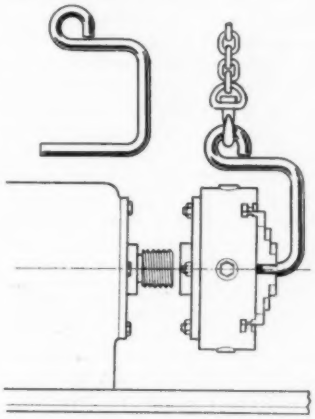



## Undersize Threaded Tubing Expanded by Balls

AFTER ABOUT 100 SHAFTS on a recent job had been nearly completed, it was discovered that the external threads had been cut about 0.002 in. undersize. Since the shafts, made from heavy steel tubing, were to be checked to close tolerances, these would have been rejected had we not hit upon a method of correcting the error. The system we used saved our company several hundred dollars and produced satisfactory work.

The center hole was ½ in., so we forced balls from 0.505 in. dia. to 0.512 in. dia. through the short bore under the threads. After expanding, the threads were rolled in an old Waterbury thread roller to insure that the profiles were correct.

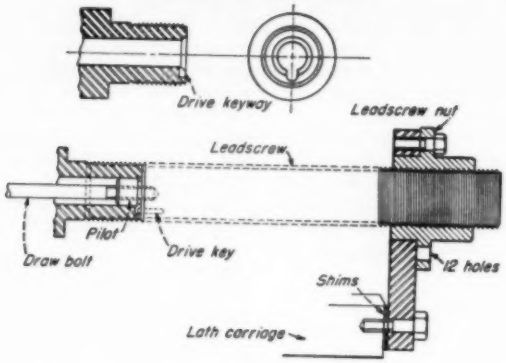
A thorough inspection proved that sizes were right. The parts were then Magnafluxed to show cracks, and all parts were found to be perfect. *Sherman S. Cross. Cuyahoga Falls, O.*



## Heavy Hook Changes Chucks

HEAVY CHUCKS and faceplates can be interchanged on large lathes by picking them up with this loading hook. Chucks are held to it by clamping the jaws on the hook's horizontal section.

The device is employed with an overhead lifting tackle and makes clumsy bolting or chain-supporting unnecessary. The hook must be made strong so it will not open under the load. The bends are made in places so that the chuck, when clamped, will hang with its center of gravity directly below the hoist. *Robert Brown, Wolverhampton, England.*




## Extra Leadscrew Guides Threading Tool

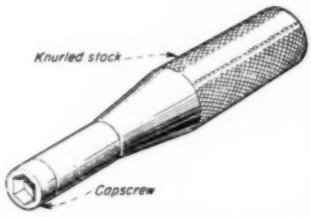
SOME TIME ago I was asked to handle a fussy lathe job that required cutting a thread on a piece of high-carbon-steel tubing. The start of the thread had to coincide exactly with a blind keyway already cut in the work. We tried a thread miller at first, but this did not give us accuracy.

It was done satisfactorily on a 14-in. engine lathe with a special setup. A leadscrew with the same dimensions as the required threaded section, but about five times as long, was cut with care. At the point where the thread ran off the left end of the screw a hole was drilled parallel to the axis in the end of the screw. A pin was then fitted into the hole to nest with little or no play in the blind keyway.

A collar was made and bored for an internal thread to fit the leadscrew. This was also drilled in 12 spots around the outside and the holes were tapped to receive a bolt. A bracket, bored to fit over the collar, and drilled and tapped to receive the bolt from the collar, was set up and bolted to the end of the lathe carriage. Between the 12 positions around the collar and shims placed between the bracket and the carriage, the collar could be moved into any position in relation to the carriage and also to the Rivett-Dock thread tool mounted on the carriage. A drawbolt held the leadscrew firmly to the work, which was collet-chucked in the lathe.

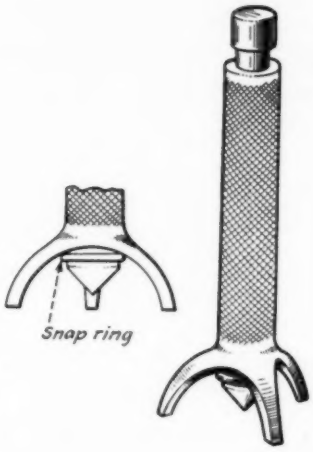
Once the setup was made, the cutting tool was aligned with the thread of the leadscrew—partly by adjustment of the thread tool, and partly by adjustment with the 12 holes in the collar and the shims. Then, as the tool was fed down into the work, it started cutting exactly over the blind keyway. This was done with the regular leadscrew of the lathe disconnected.

Fortunately the job did not require high production; because the setup made inserting and removing the work a slow process, but high accuracy was maintained, even with an inexperienced operator. *R. G. Dickens, Elmira Heights, N. Y.*




### Capscrew Forms Wrench

ASSEMBLY JOBS are speeded by a small "spintite" wrench made by screwing an Allen-head capscrew into a tapped hole in the end of a piece of bar stock. The handle is knurled for a good grip, and is turned down to the size of the screw near the working end. *Bernard Levowich, Brookline, Mass.*



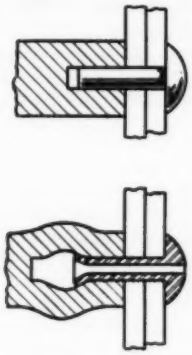

### Center Punch Aligns Itself

THIS self-aligning prick punch or center punch is both practical and accurate. The punch itself was made from drill rod turned to a slip fit inside the locating collar with a shoulder at its upper end to prevent it from dropping through. A snap ring fitting in a groove turned at the lower end of the punch prevents its falling out the other way. About ¼ in. of travel was allowed between the two stops.

The locating collar was knurled on its shank, and the three legs were faced off on the bottom perpendicular to the axis of the punch. This allows locating the punch above crossed scribed lines as well as fitting over the end of round stock to center the punch. *Charles E. Gray, Tolleson, Ariz.*

### Dryer Sides Pivoted On Blind Rivets

INDOOR DRYING RACKS, made of aluminum, for hanging clothes in winter weather were formerly assembled with plain solid rivets. These were driven through holes in the side supporting members and into blind holes in the ends of



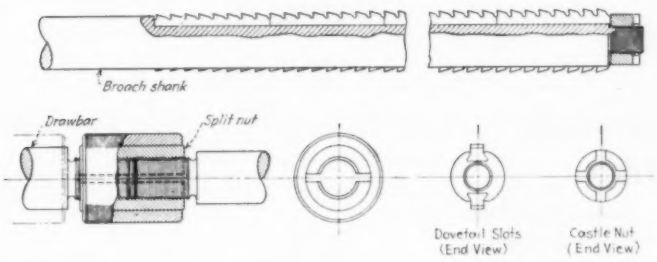

longitudinal rods with a press fit. However, the rivets worked loose in service and had to be replaced by a more positive method of holding.

Instead of a tapped hole and screw, a blind rivet was applied. After the usual hole in the rod end was drilled, the rod was upset, forming a recess inside the hole.

A blind rivet was assembled with the side members on the rod and set so its end expanded into the recess and took a positive grip. The center slug was withdrawn through the shank of the rivet, spreading the unsupported rivet but not disturbing the main rivet body or the hole in the rod. *Colgate Mfg. Corp., Amityville, L. I.*

### Emergency Air Hose Connects Small Tools

LIGHT, FLEXIBLE AIR HOSE can be made by covering rubber hose with flexible metal electric shielding. Standard hose clamps or twists of wire can be employed for connections. The resulting power line is excellent for small drilling and deburring jobs. *Charles E. Gray, Tolleson, Ariz.*




## Spline Broach Features Sectionalized Teeth

A SIMPLIFIED design of a double-spline broach is illustrated. The inserted-teeth feature allows the broach to be made with ordinary tooling and setups on standard machines.

The teeth sections are made from high-speed steel in 3-in. lengths. This minimizes distortion during heat treatment, and also allows another feature—when the teeth become worn, only the two sections at the front of the tool are discarded. New large sections are made, and the existing sections are moved one unit toward the front, then ground down to correct size. Broken teeth can be more easily replaced by sections than if the whole tool had to be remade.

The keyed shaft and coupling are made from low-carbon steel and are not heat-treated. The coupling consists of a split nut that engages threads on the shaft and on the draw bar and a knurled collar that slips over the nut halves to retain them in position.

Splines with four, six and any even number of crests can be cut, providing the teeth are the right size, by indexing the shaft and making a number of passes. *G. R. Milner, Gainsborough, England.*

**$25** *In addition to regular payment*

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An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

**PAYMENT**—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

**JUDGES** — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

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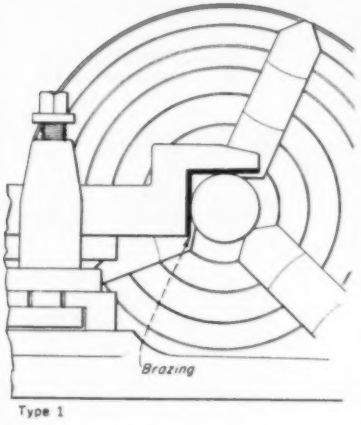
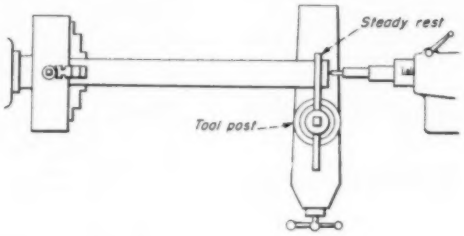
**69TH WINNER:**

CLIFFORD T. BOWER—

**Large Radius Scriber**




## Two Steadyrests Hold Bars For Centerdrilling Ends

QUICK CENTERING JOBS can be done on long shafts by setting them up with one end in a three-jaw chuck and bracing the other end against one of these two steadyrests. Since rotational speed for centering can be quite low, light hand pressure can hold the piece while the drilling is done from the tailstock.

Both rests can be clamped rapidly in a standard toolpost. Type 1 is formed by brazing a friction surface on a plain rest, while type 2 has two ball bearings. Because the rest is controlled laterally by the cross-feed on the saddle, adjustment of position can be done easily.

Many long bars, such as armatures, have no center marks, and are also too large to slip into the headstock bore, and so cannot be held by the chuck alone. On these jobs, the steadyrests save time and trouble. *Lowell F. Stull, Youngstown, O.*

### Gage Helps Reset Boring-Bar Bits

SETTING boring-bar bits so they will cut out the correct diameter accurately is always a tricky problem. The gage illustrated is simply constructed, adjustable, and will check a wide range of bar sizes.

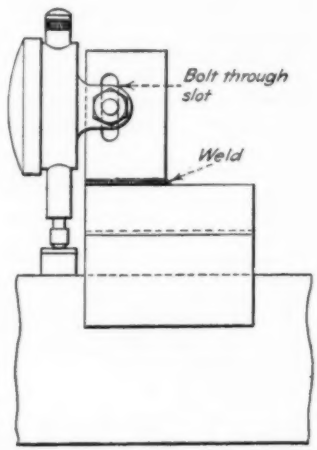
The V-block is a piece of tool steel that was shaped and ground for accuracy. The smaller block was welded onto the V-block after a slot was end-milled through it to receive a bolt that carries the dial indicator. The indicator overhangs the end of the block.

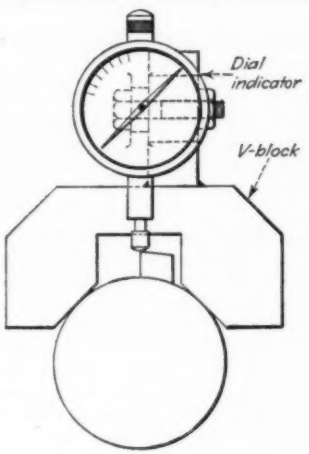
This gage is especially useful when the bit is removed from the bar for regrinding. Once the indicator is clamped, the bit can be taken out, ground, and reset to the same dial reading. *Roger Isetts, Kenosha, Wis.*

### Cement Plate Grinds Plastics

A PLASTICS-STAMPING factory recently sought for the solution of an economical problem caused by a high abrasive-belt consumption rate. These belts rough-finished and deburred plastic parts.

My solution was to make a grinding plate from cement and a little fine sand with a slightly rough surface finish. Once dry, the plate was tried out and found to be amazingly good. The parts are held gently against the plate and the burrs are removed as well, if not better, than with the conventional belts. *Federico Strasser, Santiago de Chile.*



# NEWS OF METALWORKING

## Aid for Small Businesses Predicted

WASHINGTON—If a company earns less than $1-million this year, its taxes are likely to be lower than in 1948. If it exceeds this mark, a substantial increase is likely.

In short, taxes in 1949 will hit big business, go easy on the little corporation. And it is not too soon for businessmen to begin worrying about the specifics of the forthcoming bill. Congress is just settling down to work and no one has yet completely digested the tremendous 1950 budget. But you can see the shape of things to come.

The form that the new tax bill will take has been largely determined by three facts:

1. President Truman's 1950 budget will result in a deficit, if present tax rates are unchanged.

2. The budget can't be cut very much; the Republican-controlled 80th Congress tried it but did not get very far.

3. You can hardly call the present Democratic Congress economy-minded.

Here is a comparison of the current and proposed rates:

| NET INCOME | TAXES UNDER PRESENT SCHEDULE | TAXES UNDER NEW SCHEDULE |
|---|---|---|
| $ 10,000 | $ 2,100 | $ 1,000 |
| 50,000 | 19,000 | 12,000 |
| 60,000 | 22,800 | 15,500 |
| 100,000 | 38,000 | 29,500 |
| 200,000 | 76,000 | 64,500 |
| 250,000 | 95,000 | 82,000 |
| 500,000 | 190,000 | 182,000 |
| 1,000,000 | 380,000 | 382,000 |
| 2,000,000 | 760,000 | 832,000 |

## Little Hope Seen for Liberalized Depreciation Allowances to Concerns

WASHINGTON—Business has little reason for hoping that liberalized depreciation allowances might ease the burden of the new corporate taxes. The Republicans did have a scheme last year that probably would have seemed fair to most businessmen. Called "free depreciation," it would have permitted a firm to set any rate it wanted for writing off an asset. The only catch: the firm had to maintain the rate until the equipment was written off—regardless of what happened to tax rates or the price level in the interim.

If the firm chose a high annual rate, it would of course be gambling that prices and tax rates would remain favorable. In recent years, when the trend has been consistently upward, that would be a pretty attractive chance to take.

But this Republican - sponsored proposal never was placed before the 80th Congress. And there are several reasons why it won't get anywhere in the 81st.

For one, any relaxation great enough to be felt by business would cut revenues by several billions—at a time when the administration is committed to raising more taxes.

For another, business pressure for a change will probably have eased by the time the government can afford to forego the revenues. Prices have reached a fairly stable level, and show some evidence of turning down. And no businessman would want the government to embark on a policy of adjusting amortization rates to purchasing power—possibly tighten depreciation allowances—when profits are falling.

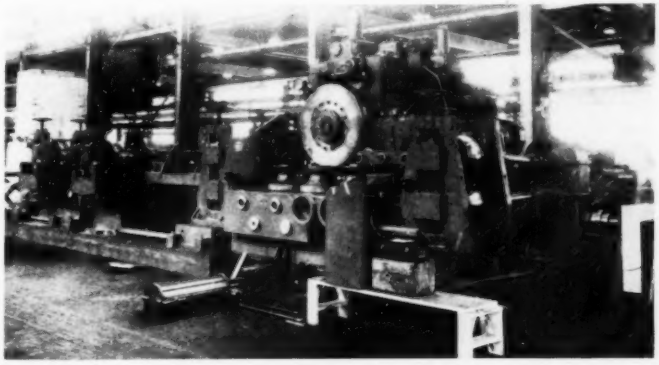
Democrats can't see why business should get any more relief from inflation than other taxpaying sectors of the economy. Letting up on depreciation might also serve to accelerate replacement, stimulate investment and add new pressures to inflation. This is precisely what administration economists fear and hope to avoid.

And, finally, Democrats say, present rates of depreciation didn't stop the boom in capital expansion. The new plants were built—mainly out of profits, of course—while dividend payments were maintained.

## GM Production to Exceed 1948 Record

DETROIT—General Motors production will reach 12,500 cars and trucks a day in 1949 if not hampered by shortages. In 1941 the production record was 11,000 and last year reached 9,000 a day.

Supporting this prediction for 1949 is the labor productivity of General Motors, which President C. E. Wilson has described as "good." This is especially true since the last wage settlement with the cost-of-living clause in the contract.



***LARGEST** electric resistance welding pipe-making machine, built by Yoder Co., Cleveland, will be shipped to Argentina. The mill, using cold steel plate up to one-half in. thick, has a capacity for producing 5-in. to 16-in. pipe or oil well casing at the rate of 15 to 60 fpm.*

***FIFTIETH** anniversary of the Potter & Johnston Co., Pawtucket, R.I., was observed by an open-house celebration Dec. 28. After a tour of the plant, workers and their families as well as visitors were presented a copy of "Fifty Years of Achievement," the story of the machine tool company's history. The firm is a subsidiary of Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford, Conn.*

## Government Unlikely to Step Into Steel Industry Despite Pressure

WASHINGTON — Despite all the hard talk since the President's State of the Union message, the administration isn't ready to plunge the government into the steel business.

For the time being, Truman's steel expansion program amounts to jawboning at industry. However, the President sincerely sees a need for more steel now—and for more and more over the years to keep the country growing.

In addition, he is under strong pressure from groups which currently are influential in Washington. For example, the auto unions, which feel the pinch in paychecks, want more steel capacity to feed the assembly lines. Then, there are the western expansionists, like Senator Murray and Assistant Interior Secretary Davidson, who think they can get most of any government-financed plants built in their own backyard. Finally, there are the reformers who just like to see the government go into business.

But Truman meant it when he asked for a study of capacity needs as the first step. He and the moderates around him think that such a procedure might in itself result in the creation of new capacity.

Here's the strategy behind the study idea: The threat of competition by Washington is a powerful one. It might be strong enough to prod industry into doing more on its own. And even if it didn't, there would already be on hand the documentation that would be necessary in selling the program to the people and to Congress.

A congressionally-conducted study of steel needs—or a lack of them—would probably elicit an avalanche of statistics and arguments, for or against government-sponsored expansion. Some of the arguments have been presented before. For each side, they run something like this:

For expansion: Senator Murray and others have long been calling for an increase in basic ingot capacity of 10-million tons a year; they say that at least that much is needed if the U.S. economy is to have enough steel to meet any national emergency and to support continued full employment.

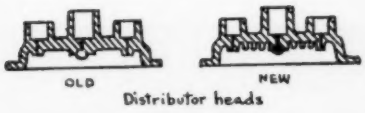
Against expansion: Industry spokesmen claim that estimates of unsatisfied demand have been vastly over-rated. And those users who did have to go without in 1947 and 1948 will be taken care of out of the 4-million-ton-plus post-war expansion program that is rapidly nearing completion. Now that pent-up demand for steel-using consumer durables is almost satisfied, a return to normal conditions should end all talk of scarcity.

## Industrial Scrap Drive Started

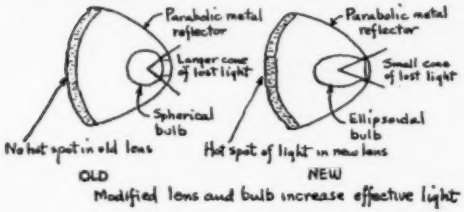
WASHINGTON—Industry is being urged by the Commerce Department and the steel industry to scout around their plants and weed out obsolete machinery and other useless metal in a drive to build up the scrap reserve.

There are two reasons for the drive: the most obvious one put forth by the Commerce Department is that the aim now is to build up a "reserve" of scrap, another "stockpile" to flaunt in Stalin's face.

The more subtle, and more important, answer is that the new campaign might build up enough pressure on the scrap market to force the price down to where the steel industry, and Commerce, thinks it belongs. During the war and OPA days, scrap was pegged at $20 a ton. Shortly after the demise of OPA the price doubled and has stayed there.

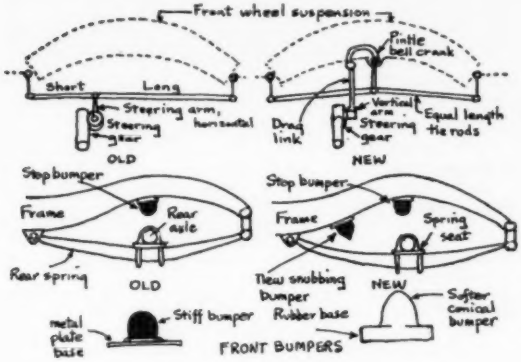


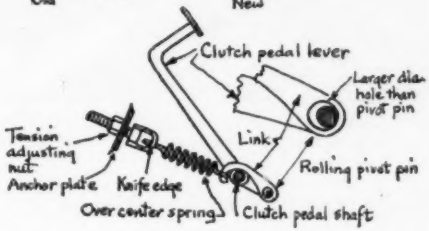
Distributor heads

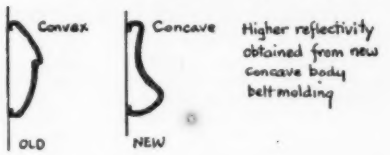


Modified lens and bulb increase effective light

***IMPROVEMENTS IN CHRYSLER*** *cars were sketched by Chester S. Ricker, from memory. These are diagrammatic, but show changes in springing, lights, and various details. Cars will be released in March.*




# Restrained Glamor Feature of Chrysler Line

BY CHESTER S. RICKER
Detroit Editor

DETROIT—At the Chrysler Preview, K. T. Keller, President of the Chrysler Corp., challenged his guests to get all the information they could about the 1949 cars, but no specifications were forthcoming. Different models from each of the Divisions, Chrysler, DeSoto, Dodge and Plymouth, were on display and members of the executive, engineering and sales staffs were at hand to answer the questions showered on them.

Here are some of the highlights gleaned from that meeting: New appearance is the first impression. The lines are modish and refined. Replaceable rear fenders (cost less than $20, someone said) enhance the body lines without penalizing the user when service is required. Wider doors, hinged at the front for convenience and safety, are found on all bodies. Chrome trim is used with restraint or eliminated. All hoods are alligator type now. Bustle or notched back decks feature the sedans because adequate head room in the rear seat is a must at Chrysler.

Larger two piece "V-type" windshields with flat glass are standard and the new larger windshield wipers sweep 44 percent more vision area. All models have a cowl ventilator and assure fresh air ventilation even in heavy traffic. Headlights are higher and wider apart for better road illumination and conformation to body lines which are wider and lower.

Wrap-around bumpers are provided at each end, those at the rear fit a depression in the fender. The stop, license plate and automatic back up lights are combined with the handle and lock by a mounted die casting on the trunk lid. "Super-cushion" tires on 15-in. wheels are used on all models. Their size ranges from 6.70-15 on the Plymouth to the 8.20-15 on the Chryslers.

Industry-wise, the announcement of economy models by Plymouth and and Dodge Divs., is probably the most startling new trend. Each has three body styles; Plymouth and Dodge will both have a coupe and a 2-door sedan, but the former will have an "all-steel" painted station wagon called "Suburban" and the latter a roadster with folding cloth top and metal-framed plastic door windows which are removable and can be stowed behind the seat. Both of these new economy chassis will have wheelbases about 8 in. shorter than the standard.

Another interesting step is the application of the automatic transmission to Dodge "Coronet" series as optional equipment and as standard equipment on both DeSoto and Chrysler. "Fluid Drive" will be on all models except those of the Plymouth Div., and the short-wheelbase Dodge.

"Cycle-weld" bonded brake lining will be standard equipment on all Chrysler cars for 1949 and the bonding department is being rapidly expanded at the Lynch Road plant of the corporation. It is claimed that up to 50,000 miles on a set of brakes is possible now.

Over-all car lengths generally have been reduced to make garaging easier, wheelbases increased to allow wider rear seats and improve the ride, narrower treads to accommodate the new tire sizes, and lower bodies by several inches but without sacrificing head room. Although bodies are narrower over-all, the new positioning of the rear seat ahead of the wheel house has permitted widening it about 7 in., and the front 6 in. Seat cushions are from 1 to 2 in. higher for greater comfort.

*NEW CALIFORNIA PLANT of Nash Motors at El Segundo comprises 500,000 sq. ft. of floor space and is situated on a 30-acre tract. A yearly production of 25,000 automobiles is the goal at this plant*

## Southern California Auto Industry Almost Doubles Prewar Production

LOS ANGELES—The southern California automobile industry—a lusty enterprise before the war—has more than doubled in volume in the postwar years.

During the last prewar year it turned out 154,000 cars and employed 5,000 people. Authoritative figures show that on Jan. 1 the local industry was geared to produce 350,000 vehicles a year, with an employment roster of 11,000 people and a $40-million payroll.

Latest to follow the Western trail in automobile manufacture is Nash-Kelvinator Corp., with its new El Segundo plant. Campbell Wood, manager of the plant, revealed that when full production of 80 cars per day is reached in March it will employ 750 people and add $2,500,000 directly to payrolls in the Los Angeles area.

He pointed out that the limited production of Nash's Western factory precludes the possibility of immediate purchase of many components because of tooling problems. He added, however, that the company plans to buy locally as many parts and supplies as possible since "there is much to be gained by taking advantage of the initiative and enterprise of the skilled and talented in industry in this area."

**Local Buying Planned**

Campbell indicated that Nash Motors, like other established car assembly plants, would eventually purchase a large percentage of parts and components from local suppliers.

Parts production was given a big boost last year when Ford Motor Co. launched its $60-million West Coast parts procurement program.

Despite the fact that there is at the moment a critical shortage of basic materials in the Los Angeles area, manufacturers and assemblers are optimistic for the future. Columbia Steel Corp. plans to get a 300,000-ton cold roll mill in operation early in 1949.

**Production Mounting**

Meanwhile, the upward push of local automobile production gathers momentum. At Long Beach, Ford employs 1,200 people, has a $4,500,000 annual payroll and 40,000 cars and trucks rolling off the line per year.

The Lincoln-Mercury Division of Ford Motor also employs 1,200 people, for $3.5 million a year. Production at this plant started in March, 1948, in a completely new building and is expected to reach a total of 18,000 automobiles by the end of the year.

Chevrolet, Fisher Body and General Motors parts division at Van Nuys started production in December, 1947. Estimated output for 1948 may reach 50,000 trucks and passenger cars. Annual payroll is $8 million for 1,500 employees.

In Southgate, Buick, Pontiac and Oldsmobile estimate the 1947 output at more than 65,000 cars. Annual payroll amounts to $6,750,000 for 2,150 workers.

Chrysler Motors of California, with 1,200 employees, has been busy on the east side of Los Angeles producing 300 vehicles a day, while Willys-Overland estimates it will turn out 4,125 units in 1948. A spokesman for the company said the output of jeeps, jeepsters, trucks and station wagons would soon be expanded to 20,000 a year.

A newcomer to the automotive field, Kaiser-Frazer, currently is holding in standby a portion of the Douglas Aircraft plant at Long Beach, which it leased from the federal government.

And in Vernon, President C. K. Whittaker of the Studebaker Pacific Corp. assembly plant, has been conferring with executives from the South Bend, Ind., main plant regarding Western expansion.

## F. J. Kamin's Article Wins IFMA Contest

NEW YORK—Floyd J. Kamin, Kamin Die Casting & Mfg. Co., Chicago, won first prize of $1,000 for his article, "Two-Chamber Induction Melting Furnace Lowers Aluminum Die Casting Cost," in the Industrial Furnace Manufacturers Association competition. The article was published in the September, 1948, issue of Materials & Methods.

Second prize of $300 went to Thomas A. Frischman, chief metallurgist, Axle Division, Eaton Mfg. Co., Cleveland, for his article published in the September 9 issue of Iron Age entitled "Controlled Atmosphere Cycle Annealing."

Stanley Wishoski, National Industrial Publishing Co., Pittsburgh, took third honors and $200 for "Continuous Carburizing and Hardening of Piston Pins at the Ford Rouge Plant," published in the October, 1947, issue of Industrial Heating.

# Farm Equipment Output Sets Record; Buyers' Market Seen This Year

CHICAGO—Output of the American farm equipment industry during 1948 set an all-time record. Estimated to be about $1,450,000,000, 1948 production exceeded the peak reached the previous year by 15%. Biggest gains were in tractors and tractor-powered equipment.

Makers of agricultural implements expect 1949 production to equal 1948 in most products. Only a few classes of equipment will be in short supply, and most manufacturers expect to have to intensify their sales efforts. No longer are farmers buying what they need as soon as it becomes available. Nor are they willing to pay black market prices, except for the larger units—heavy-duty tractors, hay balers, combines. Before 1949 is half over the industry should be able to give customers prompt delivery of all but a few items.

The industry expects sales to be good for several years. Farm incomes probably will remain high; the present Congress isn't apt to cut back price support programs. And about 5% of total farm income usually is invested in the purchase of farm machinery. Steel and other needed materials probably will be easier to get. Much depends upon demands which organized labor may make upon management in 1949. Last year strikes in its various plants cost International Harvester the production of 12,426 tractors, 6,000 combines, 11,200 corn pickers and 510 hay balers—all items that still are on the shortage lists.

**Quality Improved**

Most farm equipment makers have improved the quality of their products since the war and have developed new lines. Bigger and more powerful units have been designed for the large farm, improved small units now are available to make it more economic to mechanize the small farm, and various tillage tools have been devised to further soil conservation practices.

Major tractor makers report that future tractor requirements have led them to invest considerable sums in increased production facilities. The 1945 census showed 5,859,169 farms in the United States, using 2,400,000 tractors. It is estimated that about 3 million farms are partially or fully mechanized. This leaves nearly the same number of farms without tractors. Moreover, many farms with tractors need additional units as auxiliary power equipment for more efficient operation.

A recent Department of Agriculture survey indicates farmers in the corn belt and plains states rapidly are approaching 100% dependence on tractor power and that tractor power performs 96% of the plowing work in the four plains states, and 92% in the five corn belt states. Other major farm tasks show similar high mechanization in these nine states.

International Harvester attained all-time high sales of $945,486,000 in 1948, an increase of 27% over the 1947 total of $741,252,000 and almost double the 1946 figure of $482,328,000. Harvester exports were 13.1% of total sales last year, compared with 14.7% in 1947 and 13.8% during the years 1927-1941. The export pattern did not change appreciably in 1948, about half of the export total being farm equipment.

**Capital Expenditures High**

In the four-year period 1945 to 1948, Harvester made the largest capital expenditures in its history ($184 million) mainly for modernizing production facilities and adding six new plants. This expansion has created 30,000 to 35,000 new jobs and has increased factory floor space from a prewar total of 22,059,000 sq. ft. to more than 29 million square feet at the end of 1948. The company has opened two new parts depots (Baltimore, Md., and Richmond, Calif.), will add one in St. Paul late in 1949, and has purchased ground for three more. These depots will make possible more prompt shipment of parts to customers than was possible when such shipments had to be made from factory stocks.

Deere & Company, second largest maker of farm machinery, reports sales of $309,737,221 for 1948, compared with $212,014,979 for 1947 and $125,167,135 in 1941. As a result of a long-range factory expansion program, the company's production is the greatest in its 111-year history. Excluding Canada, 1947 and 1948 exports accounted for less than 10% of total sales.

Deere now is engaged in a modernization program which will result in the most efficient use of increased factory facilities. Part of it consists of transfer of certain implements from the Moline and East Moline factories to the new Des Moines works.

**Self-Propelled Combine**

Among the more important new implements introduced by Deere since the war are the 12-ft. self-propelled combine, which requires only one man for its operation; the one-man automatic hay baler with capacity of 3 to 4 tons an hour; and the cotton harvester-stripper which is claimed to save up to $30 a bale over hand picking. Among new implements to be introduced during 1949 are the Model MT tricycle-type tractor which will pull two 12-in. bottom plows under normal conditions; and the two-row, power-driven stalk cutter designed to do a more thorough job of cutting and shredding corn, cotton and other row-crop stalks.

Sales of Oliver Corp. for the fiscal year ended October 31, 1948, jumped 40% over the 1947 total to a new high of $103,310,462. The 1947 total, in turn, represented an increase of 45% over the preceding year. Expenditures for new plants, equipment and modernization during 1948 amounted to $6,806,000, including a new forge shop at South Bend, a new sales branch at Memphis; and a new assembly line and building at Charles City, Iowa. Capital expenditures this year probably will total more than $3 millions.

The 1948 sales total for Massey-Harris Company was substantially greater than for 1947, and was in excess of ten times the company's normal prewar volume. It represents an all time high. The company expects that production requirements will remain high throughout 1949.

***HENRY J. KINGSBURY,** chief engineer of Hammond Machinery Builders, Inc., Kalamazoo, Mich., has entered partial retirement after 50 years of service. He will continue active with the company in its engineering and development*

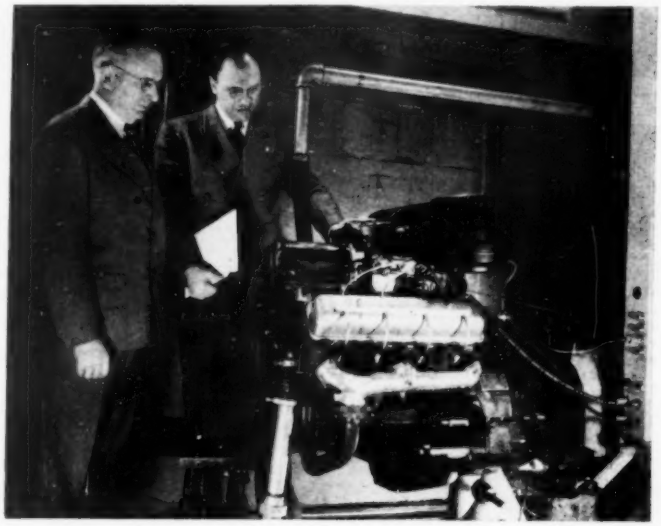
# Detroit

**MAJOR AUTO RETOOLING PROGRAMS COMPLETED... SEVERAL MODERATE PROJECTS IN OFFING... FIRMS CUT SCHEDULES**

**Looking ahead** to the medium term, not much is promised from the automobile industry in the way of major retooling programs. Farther ahead, however, possibilities are indicated.

The one program of consequency which seems to be on the verge of release—if indeed some portions have not already been let out—is for a new model by Kaiser-Frazer Corp. which is aimed at a lower price field than the present entries of the Willow Run company. Present plans are to have this job ready for the 1950 market. Details are as yet vague.

Olds has let go with releases on equipment for increasing the capacity of its new high compression engine plant at Lansing, Mich. The bulk of this is in special machinery, matching the transfer type equipment throughout the new plant. Practically all of it simply duplicates bottleneck machines already installed, so delivery promises are at least as good as the fairly short promises in the general machine tool market.



***HIGH-COMPRESSION V-8** automotive engine is studied by Charles L. McCuen (left), General Motors vice president and general manager of GM Research Laboratories, and Darl F. Caris, head of the Research advance engine department. GM Research will supply these 12-to-1 compression ratio engines, modifications of the GM Oldsmobile "Rocket" engine, to petroleum companies for the research on future high-octane fuels*

### $10 Million for Tooling

Continental Motors Corp. is releasing equipment orders for its recent $28-million contract for air-cooled powerplants for Ordnance vehicles. About $10 million of this military award is for tooling the job, indicative of its substance.

Packard's automatic transmission job is pretty well released, although there are reports that some few machines remain to be ordered. A good share of the Chevrolet automatic transmission job—which is unlikely to appear this year, although plans are not finalized in any respect—seems to have been given out.

That accounts fairly well for programs in progress. Little looms in the visible horizon beyond them to make a splash of real size in the machine tool industry.

One hope had been that Buick, Pontiac, and Chevrolet might finalize plans for high compression engines like those of Olds and Cadillac, and release them. This hope does not now seem founded in fact. For one thing, General Motors feels that there is not at present a sufficient supply of high octane gasoline at hand or in sight to permit production of more high compression engines than are at present earmarked for the two divisions already building them. For another thing, there seems to be some controversy right within the GM divisional executive family as to whether the investment for new engine plants, and then the higher cost of the products and the fuel they require, can justify the savings in gas consumption ultimately obtained by the motorist.

### Body Changes Unlikely

Postwar body changes have now been made by all producers, and this means that no large die programs are in prospect for at least a year or two. Certainly through 1950 nothing of consequence is indicated in this line, although 1951 may well see new steps taken. Of course this does not preclude substantial year-to-year changes falling in less major category.

None of this takes into account one major condition which many auto industry analysts see developing. The state of the market is passing through a transition which is creating the first semblances of competition—of a seeking out of buyers—since 1938. The character of the automobile business has definitely changed since Dec. 1. It no longer lies in an unqualified seller's market. Whenever it becomes a competitive buyers' market, the search for sales will be led by new designs—which means new tooling.

Market transition has been indicated by reliable signs. One has been the widely noted sharp break in used car prices before the end of the year. Another was the production cutback of Kaiser-Frazer from about 3,300 assemblies a week to 1,600 during mid-January, ascribed by the Willow Run company to the effect of credit limitations on sales.

### Carloadings Off

Some further confirmation of the uncertain attitude of the auto companies is seen in the reports to railroads on carloadings for the first quarter. The anticipations were that about 110,000 cars would be required, compared with 122,674 actually used in the first three months of 1948. Part of the 9.5% decline can be attributed to some transfers of shipments from rails to over-the-road transport, but not all of it.

# Names in the News

J. S. Gillespie

A. F. Dobbrodt

**Harry Crump** has been named assistant to the sales manager; **J. S. Gillespie** has been appointed manager of Tool and Wear Parts Sales Engineering; and **A. F. Dobbrodt** has been advanced to manager of Mining Sales Engineering. All these changes took place recently in Carboloy Co., Inc., Detroit.

**Frank H. Stohr** has been named general manager of the Allis-Chalmers Manufacturing Co.'s Norwood Works. He was executive vice-president and a director of the Elliott Co. of Jeannette, Pa. He succeeds **R. W. Davis,** general manager of the plant since 1944. Davis, who has been a member of the Allis-Chalmers organization for 40 years, will continue in an advisory capacity to the general manager.

**Leroy C. Dubs** has been elected president of the jointly-operated Canton Pattern & Mfg. Co. and Canton Stoker Corp., Canton, Ohio. Mr. Dubs succeeds his father, the late Theodore M. Dubs.

**William R. Moore** was elected a director of Norton Co., Worcester, Mass., at the 63rd annual stockholders meeting. He is currently a vice-president of Norton Co.

**A. A. Gustafson** has been appointed as representative in Minnesota and Iowa territories for the Palnut Co., Irvington, N. J. His headquarters will be at 2580 University Ave., St. Paul 4, Minnesota.

**B. O. Stoothoff** has been appointed as special representative of the Cleco Division of the Reed Roller Bit Co., Cincinnati, Ohio.

**O. O. Lewis** has been promoted from assistant sales manager to sales manager of Fairbanks-Morse & Co., Chicago.

Harry Crump

**Fred** and **August Sneller,** who operated the Euclid Machine & Tool Co., Cleveland, Ohio, have dissolved partnership, with August Sneller retaining ownership of the company. August Sneller has formed a new corporation, the Sneller Machine & Tool Co., and will manufacture a general line of machine tools and welding machines. Fred Sneller has formed the Euclid Universal Gear Co., which manufacture gears and gear reducers.

**C. S. Stuckenholt** has been elected president of the W. J. Schoenberger Co., Cleveland. Resignation of **W. J. Schoenberger** as president was regretfully accepted.

**William E. Gahl** has been appointed chief engineer of Templeton, Kenly & Co., Chicago, manufacturers of Simplex Jacks. He succeeds **F. J. Jakoubek** who has resigned to enter the manufacturing business for himself.

The L. S. Starrett Co., Athol, Mass., announces the following changes in personnel: **Carlton S. Phillips,** formerly N. Y. branch manager has been appointed Eastern Sales Manager; **Walter W. Haskins,** formerly Chicago branch manager, has been appointed Western sales manager; **Carl O. Newton,** has been named N. Y. branch manager to succeed Mr. Phillips; **Robert J. Norwalk** has succeeded Mr. Haskins as Chicago branch manager.

**Floyd V. Snodgrass** has been named general manager of the Nordstrom Valve Division's Oakland, California plant of the Rockwell Manufacturing Co.

**Erwin J. Schmiel** and **Ralph O. Wirtemburg** were appointed secretary-treasurer and sales manager of the Norma-Hoffman Bearings Corp., Stamford, Conn.

**F. A. Nealon,** sales manager of the Merchandising Division of the Electric Auto-Lite Co., today announced his resignation.

**R. L. deBrauwere** was elected assistant vice president of the Scovill Mfg. Co. at the Dec. Board Meeting in Waterbury, Conn. He is continuing as assistant secretary of the Scovill Mfg. Co. and as secretary and director of A. Schrader's Son, Inc., Brooklyn, N. Y.

**A. Oram Fulton** was elected chairman of the Board of Directors and Executive Officer and he also continues as treasurer of Wheelock, Lovejoy & Co., Inc. **Frederick H. Lovejoy,** who has been executive vice president for many years, was elected president to succeed Mr. Fulton in that office.

**D. D. Moffat,** vice president and manger of the Utah division of Kennecott Copper Corp., and **J. D. Shilling,** assistant general manager, retired Dec. 31, each after 50 years in the industry. **Louis Buchman,** formerly general superintendent of operations, was named to replace Moffat and **E. W. Engelmann,** general superintendent of mills, to replace Shilling. Overall supervision of Kennecott's Utah Division will be placed in the hands of Kennecott Vice President **J. C. Kinnear,** who heads the firm's operations in Nevada, Arizona, and New Mexico.

**William Seymour, Jr., C. L. Hardy,** and **Thomas G. Miller,** have been elected vice president, assistant vice president, and secretary, respectively, of the Joseph T. Ryerson & Son, Inc., Chicago, Ill.

**M. W. Reed** has been appointed engineering vice president of the U. S. Steel Corp., to succeed **B. H. Lawrence,** who is retiring after over 44 years of service.

A. L. Hawley

**A. L. Hawley,** formerly assistant works manager of the Plomb Tool Co., has been appointed works manager of the main factory in Los Angeles.

## BUSINESS ITEMS

**Snow Mfg. Co.,** Bellwood, Ill., a suburb of Chicago, is opening a direct factory branch office, 720 Euclid Avenue, Cleveland, Ohio. It will handle all sales and service in the Cleveland and northern Ohio area, on the Snow line of full universal drilling, tapping and threading machines from this office.

**Myron Zucker Engineering Co.** of Detroit has been named representative in Southeast Michigan and Toledo for Precision Welder and Machine Co., Cincinnati, Ohio, manufacturers of resistance welding equipment.

**The Sperry Corporation,** which since 1945 has owned 50 percent of Wright's Automatic Machinery Co., Durham, N. C., has purchased the remaining common stock in the 56 year old Durham firm, pioneer developer and manufacturer of automatic packaging machinery.

**G. A. Gray Co.,** Cincinnati, Ohio, builders of Metal Planers, Planer Type Milling Machines, and Horizontal Boring Machines, is pleased to announce the appointment of the W. E. Shipley Machinery Co. of Philadelphia as exclusive distributors for the Philadelphia and Baltimore territories.

**Castle Die, Tool and Machine Co.,** Columbus, Ohio, has been chartered to manufacture and deal in machines and machinery.

**More-Handley Hardware Co., Inc.,** of Birmingham, Ala., has announced the construction of a 117,000 square foot warehouse and office in Nashville, Tenn.

Surplus, government-owned steel facilities in Warren, Ohio, and the adjoining privately-owned steel plant of the **Copperweld Steel Co.** are being offered for sale together, War Assets Administration announced today.

**McNeil Machine & Engineering Co.** announced today that it had taken over the **Cleveland Crane & Engineering Co.** by acquiring more than 90 per cent of its capital stock.

The **American Optical Co.** has purchased a 6-acre tract at Stamford, Conn., to create a research laboratory in the expansion of the research program of the company.

**Revere Copper & Brass, Inc.,** has announced the formation of a Pacific Coast division headquartered at the company's new Los Angeles mill. Manufacture of copper and copper alloy tube and brass rod was scheduled to start this month.

**Rheem Manufacturing Co.** has reported that the tenth affiliated overseas plant of its organization is nearing completion at Buenos Aires, Argentina. Capitalized at about $500,000, the 30,000 sq. ft. plant will be producing steel shipping containers by March.

**Black & Decker Mfg. Co.** of Towson, Md., announces that a new Factory Service Station is being opened in February in Cincinnati, Ohio at 1094 Gilbert Ave.; while the Denver Service Station has moved to a new building located at 1010 Bannock St. The addition of the Cincinnati Branch increases the number of service stations operated by Black & Decker to 25 in the U. S.

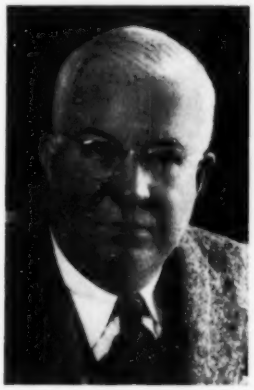
**Acro Electric Co.,** Cleveland, manufacturers of Rolling Spring Snap Action Switches, has been purchased by a group of Pittsburghers including Willard F. Rockwell, Jr., president of the Rockwell Mfg. Co. of Pittsburgh.

**Ardun Co.,** Tulsa, Okla., has been appointed a distributor of Tube-Turn welding fittings and flanges. The firm is a partnership formed by two Tulsans, H. W. (Doc) Arduser and Robert H. Duenner, Jr. Both are highly competent engineers as well as top-flight businessmen.

**Plomb Tool Co.,** resumed manufacture of finished tools early in January at its Los Angeles and Jamestown, N. Y., plants, using the trademark "PROTO" with the legend "Los Angeles—Mfd. USA."

**Kaiser Co., Inc.,** has announced a record-breaking output of steel ingots from its Fontana plant in 1948, 853,000 tons, as compared to 796,000 tons in 1947. Henry J. Kaiser said that with the completion of new open hearth facilities last December, he anticipated 1949 steel ingot production of more than 1,000,000 tons.

## OBITUARIES



George W. Emrick

**George W. Emrick,** chairman of the board of the Ettco Tool Co., Brooklyn, N. Y., and president of the company until two years ago, died Wednesday in Palm Beach, Fla., where he was spending the winter. He held many patents on drilling and tapping attachments as well as multiple drill and tapping heads.

**Lee Dale Mercer,** 74, assistant sales director in the sheet and strip division of the Republic Steel Corp., died Jan. 11 at his home in Cleveland.

**Clifford A. Wamba,** 51, former president of the Northwest Machine Works, Tacoma, Wash., died Jan. 6 at Seattle, Wash. He sold the machine works three years ago and had been in semi-retirement since that time.

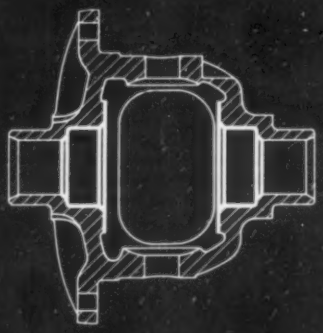
**Selden W. Tyler,** president and general manager of the Hamilton Emery and Corundum Co., died Jan. 14.

**William L. Stancliffe,** 65, former vice president in charge of sales of the American Car and Foundry Co. died Jan. 16.

**Charles Cameron Carr,** 66, veteran ordnance manufacturing expert, died in Cincinnati, Jan. 8. He was associated with the R. K. LeBlond Machine Tool Co. for 44 years.

**Cecil Henry Bacon,** 75, president of the Bacon & Matheson Forge Co., Seattle, from 1918 to 1930, died Jan. 5. He sold the steel manufacturing firm in 1930 to the Pacific Car & Foundry Co.

*Another Special by Cross*



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## An *Automatic* Machine for Differential Case Side Gear Pockets

- ★ Bores and faces side gear pockets of differential cases.
- ★ 100 pieces per hour.
- ★ Operator merely loads and unloads and presses cycle button.
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**SPECIAL MACHINE TOOLS**

MILLING • DRILLING • TAPPING • BORING • TURNING • SHAPING • GRINDING • HONING

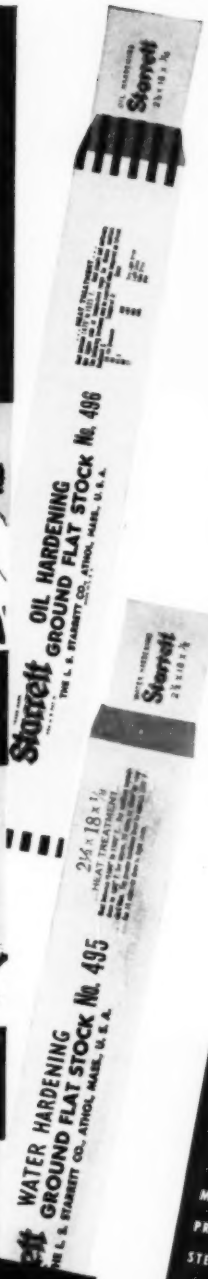
# SAVE 2 OPERATIONS

Producing Small Precision Parts

*Just* **LAY IT OUT...**

*and* **CUT IT OUT**

USE STARRETT BAND SAWS

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## PRECISION GROUND
# FLAT STOCK

Hunting up stock and grinding it to size for parts like special gages; templates; jig, fixture and machine parts; punch dies; etc., ties up men and machines—takes time that can be put to better use today. A supply of STARRETT Precision Ground Flat Stock will stop that waste. Your STARRETT Distributor carries a complete stock. Order a supply today.

STARRETT Precision Ground Flat Stock is high grade annealed tool steel cut lengthwise from the sheet and ground to within .001" in thickness, 18-inch lengths, widths from ½ to 6 inches, thicknesses from 1/64" to 1" and more. Each piece individually wrapped and marked with size, type and heating instructions.

### No. 496 OIL HARDENING

A non-deforming, electric furnace tool steel, fully spherodized annealed with fine grain structure and deep hardening characteristics. Ideal for precision parts which require accuracy of size after hardening.

### No. 495 WATER HARDENING

A high grade tool steel specially annealed for easy machining. Develops maximum hardness when quenched in water or brine and may be drawn to any desired temper in oil.

***Write for Ground Flat Stock Folder and Chart "C" giving Formulas for both Oil and Water Hardening***

Starrett

*Standard of Precision*

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS · DIAL INDICATORS STEEL TAPES · HACKSAWS AND BAND SAWS PRECISION GROUND FLAT STOCK

*Buy Through Your Distributor*

**THE L. S. STARRETT CO.** · *Worlds' Greatest Toolmakers* · **ATHOL, MASSACHUSETTS, U.S.A.**

# Conversion Table for Ten-Thousandths to MM.

COURTESY NATIONAL JET COMPANY

*This table is useful in micro-drilling and instrument work.*

| INCH | MM | INCH | MM | INCH | MM | INCH | MM | INCH | MM | INCH | MM | INCH | MM | INCH | MM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .0010 | .02540 | .0060 | .15240 | .0110 | .27940 | .0160 | .40640 | .0210 | .53340 | .0260 | .66040 | .0310 | .78740 | .0360 | .91440 |
| .0011 | .02794 | .0061 | .15494 | .0111 | .28194 | .0161 | .40894 | .0211 | .53594 | .0261 | .66294 | .0311 | .78994 | .0361 | .91694 |
| .0012 | .03048 | .0062 | .15748 | .0112 | .28448 | .0162 | .41148 | .0212 | .53848 | .0262 | .66548 | .0312 | .79248 | .0362 | .91948 |
| .0013 | .03302 | .0063 | .16002 | .0113 | .28702 | .0163 | .41402 | .0213 | .54102 | .0263 | .66802 | .0313 | .79502 | .0363 | .92202 |
| .0014 | .03556 | .0064 | .16256 | .0114 | .28956 | .0164 | .41656 | .0214 | .54356 | .0264 | .67056 | .0314 | .79756 | .0364 | .92456 |
| .0015 | .03810 | .0065 | .16510 | .0115 | .29210 | .0165 | .41910 | .0215 | .54610 | .0265 | .67310 | .0315 | .80010 | .0365 | .92710 |
| .0016 | .04064 | .0066 | .16764 | .0116 | .29464 | .0166 | .42164 | .0216 | .54864 | .0266 | .67564 | .0316 | .80264 | .0366 | .92964 |
| .0017 | .04318 | .0067 | .17018 | .0117 | .29718 | .0167 | .42418 | .0217 | .55118 | .0267 | .67818 | .0317 | .80518 | .0367 | .93218 |
| .0018 | .04572 | .0068 | .17272 | .0118 | .29972 | .0168 | .42672 | .0218 | .55372 | .0268 | .68072 | .0318 | .80772 | .0368 | .93472 |
| .0019 | .04826 | .0069 | .17526 | .0119 | .30226 | .0169 | .42926 | .0219 | .55626 | .0269 | .68326 | .0319 | .81026 | .0369 | .93726 |
| .0020 | .05080 | .0070 | .17780 | .0120 | .30480 | .0170 | .43180 | .0220 | .55880 | .0270 | .68580 | .0320 | .81280 | .0370 | .93980 |
| .0021 | .05334 | .0071 | .18034 | .0121 | .30734 | .0171 | .43434 | .0221 | .56134 | .0271 | .68834 | .0321 | .81534 | .0371 | .94234 |
| .0022 | .05588 | .0072 | .18288 | .0122 | .30988 | .0172 | .43688 | .0222 | .56388 | .0272 | .69088 | .0322 | .81788 | .0372 | .94488 |
| .0023 | .05842 | .0073 | .18542 | .0123 | .31242 | .0173 | .43942 | .0223 | .56642 | .0273 | .69342 | .0323 | .82042 | .0373 | .94742 |
| .0024 | .06096 | .0074 | .18796 | .0124 | .31496 | .0174 | .44196 | .0224 | .56896 | .0274 | .69596 | .0324 | .82296 | .0374 | .94996 |
| .0025 | .06350 | .0075 | .19050 | .0125 | .31750 | .0175 | .44450 | .0225 | .57150 | .0275 | .69850 | .0325 | .82550 | .0375 | .95250 |
| .0026 | .06604 | .0076 | .19304 | .0126 | .32004 | .0176 | .44704 | .0226 | .57404 | .0276 | .70104 | .0326 | .82804 | .0376 | .95504 |
| .0027 | .06858 | .0077 | .19558 | .0127 | .32258 | .0177 | .44958 | .0227 | .57658 | .0277 | .70358 | .0327 | .83058 | .0377 | .95758 |
| .0028 | .07112 | .0078 | .19812 | .0128 | .32512 | .0178 | .45212 | .0228 | .57912 | .0278 | .70612 | .0328 | .83312 | .0378 | .96012 |
| .0029 | .07366 | .0079 | .20066 | .0129 | .32766 | .0179 | .45466 | .0229 | .58166 | .0279 | .70866 | .0329 | .83566 | .0379 | .96266 |
| .0030 | .07620 | .0080 | .20320 | .0130 | .33020 | .0180 | .45720 | .0230 | .58420 | .0280 | .71120 | .0330 | .83820 | .0380 | .96520 |
| .0031 | .07874 | .0081 | .20574 | .0131 | .33274 | .0181 | .45974 | .0231 | .58674 | .0281 | .71374 | .0331 | .84074 | .0381 | .96774 |
| .0032 | .08128 | .0082 | .20828 | .0132 | .33528 | .0182 | .46228 | .0232 | .58928 | .0282 | .71628 | .0332 | .84328 | .0382 | .97028 |
| .0033 | .08282 | .0083 | .21082 | .0133 | .33782 | .0183 | .46482 | .0233 | .59182 | .0283 | .71882 | .0333 | .84582 | .0383 | .97282 |
| .0034 | .08636 | .0084 | .21336 | .0134 | .34036 | .0184 | .46736 | .0234 | .59436 | .0284 | .72136 | .0334 | .84836 | .0384 | .97536 |
| .0035 | .08890 | .0085 | .21590 | .0135 | .34290 | .0185 | .46990 | .0235 | .59690 | .0285 | .72390 | .0335 | .85090 | .0385 | .97790 |
| .0036 | .09144 | .0086 | .21844 | .0136 | .34544 | .0186 | .47244 | .0236 | .59944 | .0286 | .72644 | .0336 | .85344 | .0386 | .98044 |
| .0037 | .09398 | .0087 | .22098 | .0137 | .34798 | .0187 | .47498 | .0237 | .60198 | .0287 | .72898 | .0337 | .85598 | .0387 | .98298 |
| .0038 | .09652 | .0088 | .22352 | .0138 | .35052 | .0188 | .47752 | .0238 | .60452 | .0288 | .73152 | .0338 | .85852 | .0388 | .98552 |
| .0039 | .09906 | .0089 | .22606 | .0139 | .35306 | .0189 | .48006 | .0239 | .60706 | .0289 | .73406 | .0339 | .86106 | .0389 | .98806 |
| .0040 | .10160 | .0090 | .22860 | .0140 | .35560 | .0190 | .48260 | .0240 | .60960 | .0290 | .73660 | .0340 | .86360 | .0390 | .99060 |
| .0041 | .10414 | .0091 | .23114 | .0141 | .35814 | .0191 | .48514 | .0241 | .61214 | .0291 | .73914 | .0341 | .86614 | .0391 | .99314 |
| .0042 | .10668 | .0092 | .23368 | .0142 | .36068 | .0192 | .48768 | .0242 | .61468 | .0292 | .74168 | .0342 | .86868 | .0392 | .99568 |
| .0043 | .10922 | .0093 | .23622 | .0143 | .36322 | .0193 | .49022 | .0243 | .61722 | .0293 | .74422 | .0343 | .87122 | .0393 | .99822 |
| .0044 | .11176 | .0094 | .23876 | .0144 | .36576 | .0194 | .49276 | .0244 | .61976 | .0294 | .74676 | .0344 | .87376 | .0394 | 1.00076 |
| .0045 | .11430 | .0095 | .24130 | .0145 | .36830 | .0195 | .49530 | .0245 | .62230 | .0295 | .74930 | .0345 | .87630 | .0395 | 1.00330 |
| .0046 | .11684 | .0096 | .24384 | .0146 | .37084 | .0196 | .49784 | .0246 | .62484 | .0296 | .75184 | .0346 | .87884 | .0396 | 1.00584 |
| .0047 | .11938 | .0097 | .24638 | .0147 | .37338 | .0197 | .50038 | .0247 | .62738 | .0297 | .75438 | .0347 | .88138 | .0397 | 1.00838 |
| .0048 | .12192 | .0098 | .24892 | .0148 | .37592 | .0198 | .50292 | .0248 | .62992 | .0298 | .75692 | .0348 | .88392 | .0398 | 1.01092 |
| .0049 | .12446 | .0099 | .25146 | .0149 | .37846 | .0199 | .50546 | .0249 | .63246 | .0299 | .75946 | .0349 | .88646 | .0399 | 1.01346 |
| .0050 | .12700 | .0100 | .25400 | .0150 | .38100 | .0200 | .50800 | .0250 | .63500 | .0300 | .76200 | .0350 | .88900 | .0400 | 1.01600 |
| .0051 | .12954 | .0101 | .25654 | .0151 | .38354 | .0201 | .51054 | .0251 | .63754 | .0301 | .76454 | .0351 | .89154 | .0401 | 1.01854 |
| .0052 | .13208 | .0102 | .25908 | .0152 | .38608 | .0202 | .51308 | .0252 | .64008 | .0302 | .76708 | .0352 | .89408 | .0402 | 1.02108 |
| .0053 | .13462 | .0103 | .26162 | .0153 | .38862 | .0203 | .51562 | .0253 | .64262 | .0303 | .76962 | .0353 | .89662 | .0403 | 1.02362 |
| .0054 | .13716 | .0104 | .26416 | .0154 | .39116 | .0204 | .51816 | .0254 | .64516 | .0304 | .77216 | .0354 | .89916 | .0404 | 1.02616 |
| .0055 | .13970 | .0105 | .26670 | .0155 | .39370 | .0205 | .52070 | .0255 | .64770 | .0305 | .77470 | .0355 | .90170 | .0405 | 1.02870 |
| .0056 | .14224 | .0106 | .26924 | .0156 | .39624 | .0206 | .52324 | .0256 | .65024 | .0306 | .77724 | .0356 | .90424 | .0406 | 1.03124 |
| .0057 | .14478 | .0107 | .27178 | .0157 | .39878 | .0207 | .52578 | .0257 | .65278 | .0307 | .77978 | .0357 | .90678 | .0407 | 1.03378 |
| .0058 | .14732 | .0108 | .27432 | .0158 | .40132 | .0208 | .52832 | .0258 | .65532 | .0308 | .78232 | .0358 | .90932 | .0408 | 1.03632 |
| .0059 | .14986 | .0109 | .27686 | .0159 | .40386 | .0209 | .53086 | .0259 | .65786 | .0309 | .78486 | .0359 | .91186 | .0409 | 1.03886 |

## CONTINUOUS *Surface Broaching* FOR PEAK PRODUCTION

● Cutting the cost per piece through surface broaching provides the only available means left to produce some machined parts at a profit. In a great many cases surface broaching has shown remarkable savings in production time per piece as well as tooling maintenance costs when compared to conventional methods previously used. We will be glad to figure with you the advisability of using Footburt Surface Broaching Machines on your work. Just send blueprints and your hourly production required.

**THE FOOTE-BURT COMPANY**
CLEVELAND 8, OHIO
Detroit Office: General Motors Building

**FOOTBURT** *Surface Broaching*

FOOTBURT PATENTED TOOTH FORM

American Machinist REFERENCE BOOK SHEET

# Markings for Grinding Wheels

*An American Standard, ASA B5.17—1949, approved by the American Standards Association and published by the American Society of Mechanical Engineers*

**Purpose and Scope**—This standard applies to grinding wheels and other bonded abrasives: segments, bricks, sticks, hones, rubs and other shapes.

The standard does not apply to diamond wheels or to specialties such as sharpening stones.

This is a standard system of markings only. *Wheels bearing the same standard markings if made by different wheel manufacturers may not and probably will not produce the same grinding action.* This desirable result cannot be accomplished because of the impossibility of correlating any measurable physical properties of bonded abrasive products in terms of their grinding action.

**Sequence of Markings** — Each marking will consist of six parts, in the following sequence:

1. Abrasive Type
2. Grain Size
3. Grade
4. Structure
5. Bond Type
6. Manufacturer's Record

Abrasives naturally fall into two groups; the aluminum-oxide group and the silicon-carbide group. Letter symbols are used to identify these two groups, as follows:

A — Aluminum oxide
C — Silicon carbide

Where it is necessary to designate some particular type of these broad classes, the manufacturer may use his own symbol or brand designation as a prefix.

**Grain Size** — Grain size is indicated by a number. The following list (from coarse to fine) includes all of the ordinary grain sizes commonly used in the manufacture of grinding wheels. It conforms with Simplified Practice Recommendations R118-40.

10, 12, 14, 16, 20, 24, 30, 36, 46, 54, 60, 70, 80, 90, 100, 120, 150, 180, 220

The following additional sizes are occasionally used: 240, 280, 320, 400, 500, 600.

If and where it is necessary to indicate a special grain combination, the wheel maker may use an additional symbol appended to the regular grain symbol.

**Grade** — The grade is indicated by a letter of the alphabet, A to Z, soft to hard, in all bonds or processes.

**Structure** — The use of a structure symbol is optional. If and where it is advisable to indicate the structure in a wheel marking, a simple number symbol shall be used. Numbers from 1 to 15 will cover the range of structures being used today, but there is no reason why higher numbers cannot be used if necessary. Progressively higher numbers are used to indicate progressively wider grain spacing (sometimes called "more open" structure).

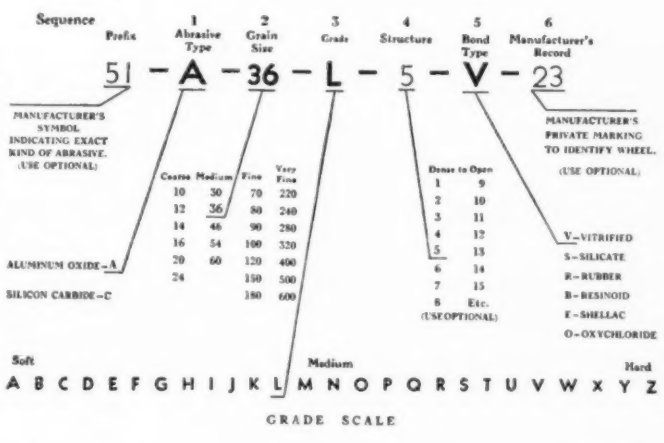
**Bond or Process** — The bond or process is designated by the following letters:

V — Vitrified
S — Silicate
E — Shellac or elastic
R — Rubber
B — Resinoid (Synthetic resins)
O — Oxychloride

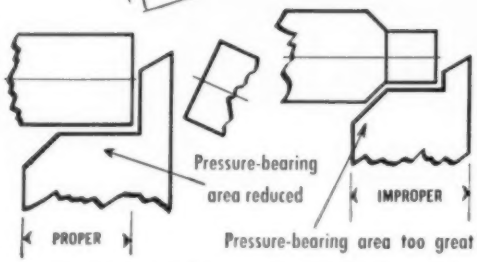
**Manufacturer's Record** — Manufacturers' records are designated by symbols. Each grinding wheel manufacturer is at liberty to use the sixth position for private factory records.

Due to the greater similarity in marking that will result in many cases from the use of this system, it is important that the user include in his records the name of the wheel maker as a part of the marking.

## STANDARD MARKING SYSTEM

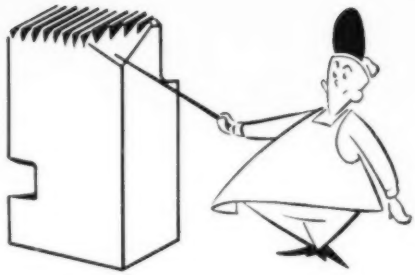


# Handy Hints for Machining ...by Stainless Sam



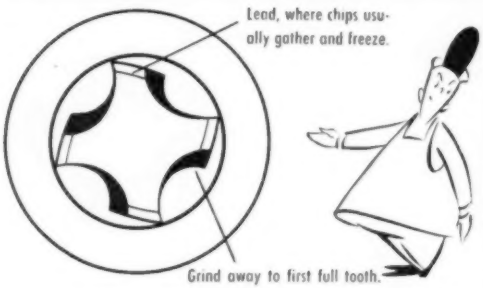

**1** When using a combination form and cut-off tool on austenitic Stainless Steels, be sure the cut-off section completely severs the part before the form tool makes contact with the bar. You can do this by increasing the length of the cut-off tool.

Pressure-bearing areas are reduced by decreasing the width of the form tool.

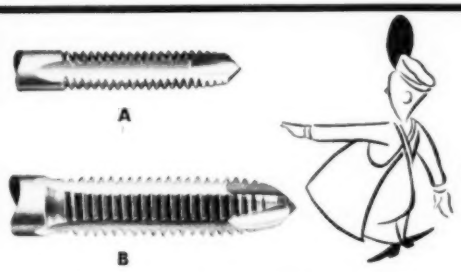


**2** When fine threads become a problem with milled-type chasers, Stainless Sam recommends grinding away the back section of the lead up to the first full tooth. The original lead of the chaser should not be touched.

This reduces the pressure-bearing area of the chaser against the work piece, permits ready flow of oil to the first full tooth, and helps prevent "welding" of the chips in the roof of the thread.




**3** In using a tap for fine threads, Stainless Sam suggests the heel of the tap be ground away to within 1/32" of the lead, but the lead *should not be disturbed*. This also reduces pressure-bearing areas and lessens the chance of "bugs" freezing at the lead.




**4** Collapsible type taps are successfully employed for large sizes (over 1" diameter). It is recommended that collapsible types of tap chasers be ground with a 15°-20° lip hook.

For through holes use two-flute taps, or the gun or chip-driver type as shown in this drawing. Figure A is a two-flute chip-driver tap; Figure B is three-flute.

Threading Stainless Steels is only one of many subjects discussed in Armco's valuable new booklet on machining.

Write for your copy today. It may surprise you to know how easy it is to machine ARMCO Stainless Steels on standard equipment. And you may be in line for another pleasant surprise if you make a cost study of each part of your product—comparing Stainless with the material you are using.

When you write for a copy of the booklet, just ask for "Machining of ARMCO Stainless Steels." Address Armco Steel Corporation, 103 Curtis Street, Middletown, Ohio.

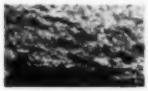
*Export: The Armco International Corporation*

**ARMCO**
**STAINLESS STEELS**

ARMCO

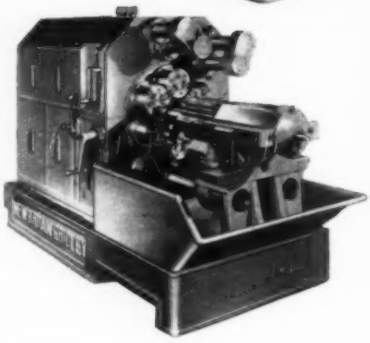
# Shop Tests for Identifying Steels

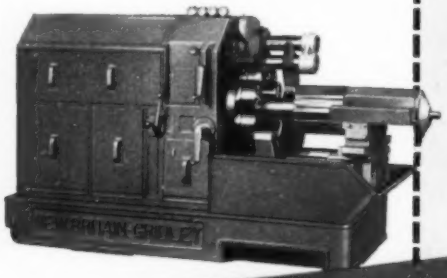
COURTESY LINDE AIR PRODUCTS COMPANY

| | WHAT TO NOTICE | LOW-CARBON STEEL AND CAST STEEL | HIGH-CARBON STEEL | ALLOY** STEEL |
|---|---|---|---|---|
| APPEARANCE | FRACTURE |  bright gray | very light gray | medium gray |
| | UNFINISHED SURFACE | Dark gray; forging marks may show; cast-evidences of mold | Dark gray; rolling or forging lines may be noticeable | Dark gray; relatively rough; rolling or forging lines may show |
| | NEWLY MACHINED SURFACE | Very smooth; bright gray | Very smooth; bright gray | Very smooth; bright gray |
| CHIP TEST | APPEARANCE OF CHIP | Smooth edges where cut | Fine grain fracture; edges lighter in color than low-carbon steel | ** |
| | SIZE OF CHIP | Can be continuous if desired | Can be continuous if desi ed | ** |
| | FACILITY OF CHIPPING | Easily cut or chipped | Metal is usually very hard but can be chipped | ** |
| BLOWPIPE TEST | SPEED OF MELTING (From Cold State) | Fast | Fast | ** |
| | COLOR CHANGE WHILE HEATING | Becomes bright red before melting | Becomes bright red before melting | ** |
| | APPEARANCE OF SLAG | Similar to molten metal | Similar to molten metal | ** |
| | ACTION OF SLAG | Quiet | Quiet | ** |
| | APPEARANCE OF MOLTEN PUDDLE | Liquid; straw color | Lighter than low-carbon steel; has a cellular appearance | ** |
| | ACTION OF MOLTEN PUDDLE UNDER BLOWPIPE FLAME | Molten metal sparks | Sparks more freely than low-carbon steel | ** |
| | | Color-white<br>Average length of stream with power grinder - 70 in.<br>Volume - moderately large<br>Shafts shorter than wrought iron and in forks and appendages<br>Forks become more numerous and sprigs appear as carbon content increases | Color-white<br>Average stream length with power grinder - 55 in.<br>Volume - large<br>Numerous small and repeating sprigs | Color - straw yellow<br>Stream length varies with type and amount of alloy content<br>Shafts may end in forks, buds or arrows, frequently with break between shaft and arrow. Few, if any, sprigs<br>Color - white |

** Alloy steels vary so much in composition and consequently in results of tests that experience is the best solution to identification problems.

# SPECIAL FEATURES...
## mean better production methods





# NEW BRITAIN
## *Automatic*
## 4-6-8 Spindle Chuckers

***HYDRAULIC CHUCKING*** for simple positive control and rapid action. Chucking pressures automatically reduced in finishing positions, if necessary to prevent distortion.

***FLAT CROSS SLIDES AND SWINGING TYPE FORMING ARMS*** make New Britains equally adaptable to heavy cuts and a wide variety of types of work.

***SPINDLE STOPPING MECHANISM*** positions spindle automatically in loading position, or any other position necessary to perform work requiring a dead spindle. A safety device prevents carrier index before completion of chucking operation.

***CARRIER LIFTING, LOCATING AND LOCKING MECHANISMS*** during index preserve initial accuracy by eliminating both wear and weave from the spindle carrier.

***DOUBLE INDEX*** of spindle carrier with loading in two positions permits finishing both ends of a piece in a single cycle, or two pieces per cycle.

***ACCELERATED OR DECELERATED MOTION,*** separate from turret, changes feed rate of any end working tool for different operations. Drill speeders in all positions.

***ANTI-FRICTION BALL BEARING*** on hydraulic chucking distributor eliminates the wear and heat of metal-to-metal contacts and permits high spindle speed.

***OPEN END CONSTRUCTION*** provides complete accessibility to the tooling area, and easy chip removal.

These important mechanical features are the basis for the adaptability and accuracy of New Britain chuckers and the new, better machining methods they make possible. May we send you the portfolio "It Can Be Done." It contains numerous cost histories showing the results in terms of cost-per-piece and pieces-per-hour. Frequent supplements are issued to those who request this valuable service.

249M11

THE NEW BRITAIN MACHINE CO.

NB

**NEW BRITAIN**

*Automatics*

**THE NEW BRITAIN MACHINE COMPANY**
**NEW BRITAIN-GRIDLEY MACHINE DIVISION**
**NEW BRITAIN, CONNECTICUT**

# Shop Equipment News

## Brown & Sharpe Introduce Electronic Adjustment of Grinder Swivel Tables

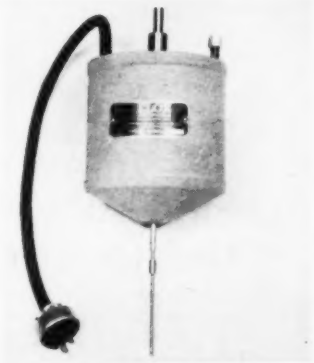
Brown & Sharpe Mfg. Co., Providence 1, R. I., offers the Electralign for the electronic alignment of grinding-machine swivel tables. The Electralign ignores the condition of the table pivot, table wear which may occur with time, the weight of the workpiece and the location of the headstock and footstock on the table. True swivel movements are indicated without relation to these variables.

The Electralign locates a strain-gage measuring head at each end of the sliding table and measures the movements of the ends of the swivel table. By making measurements with strain gages, high sensitivity is obtained and displacements of 0.0001 in. are detected and amplified to well spaced graduations on an indicating scale.

As the amplifier has a scale which is set for the work length, deflections are direct reading without interpolation or transposition. The Electralign offers close control of the swivel table position with the features of simple adjustment and wide adaptability. When it is desired to make external and internal measurements employing a comparator in conjunction with setting the table for alignment, the Electralign can be supplemented by the Electralign-Comparator Selector.

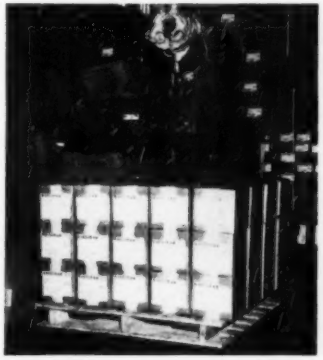
### Sponge Rubber Mats and Runners Are Available in 47-in. Units

The Atlas Sponge Rubber Co., 806 E. 61st St., Los Angeles 1, Calif., offers a line of sponge rubber mats and runners made of resilient sponge rubber, ½ in. thick by 21½x 47 in., with beveled edges; also a size of ½x21½x23 in. They are available in black or green; other colors on special order.

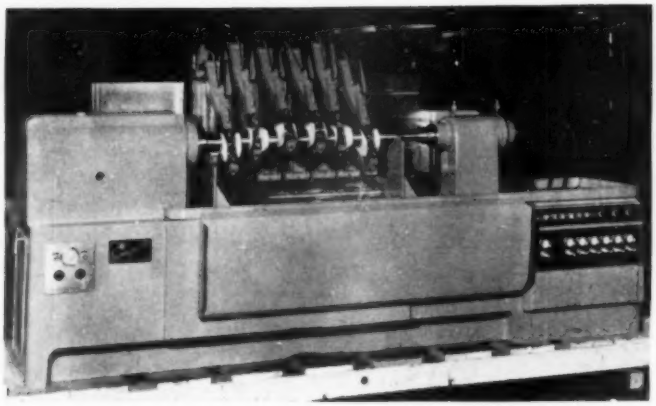


### Elox Portable Disintegrator For Removing Broken Tools

A lightweight portable disintegrator which can be kept handy on a tool-crib shelf and carried to the job in one hand, is offered by the Elox Corp., Clawson, Mich. Listed as the Model "X" broken tool, stud and pin remover, it can be set into the chuck of a drillpress. The portable disintegrator is listed at $95.



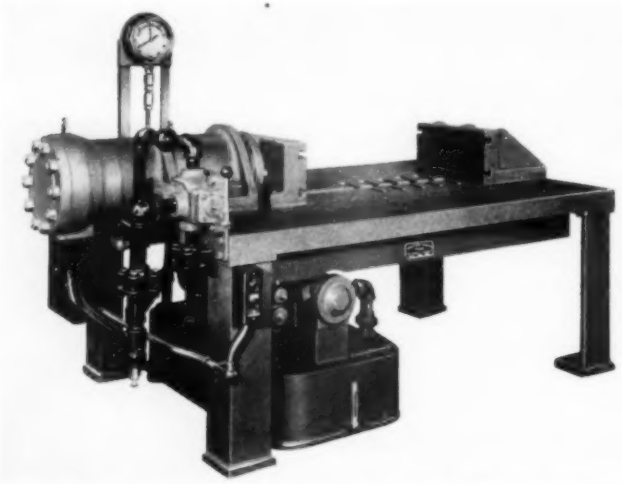
MANSAVER PALLET GRAB is offered by Mansaver Industries, Inc., 310 East St., New Haven, Conn. This grab has been designed for use for plants that wish to stack higher than the normal electric lift truck will stack. It is used for unloading motor trucks where there are no self-leveling platforms. Lifting point is over center line of load



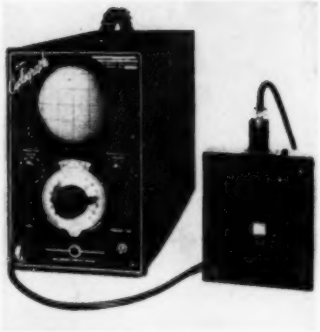
## Gisholt Crankshaft Superfinisher Handles Sizes to 60 in. in Length

The Gisholt Machine Co., 1245 E. Washington Ave., Madison, Wis., offers the Model 71 Superfinisher. The longitudinally adjustable arms permit the utilization of one machine to handle a variety of sizes of crankshafts up to 60 in. in length. Special snap-on stone holders are of the quick-change type enabling fast replacement of stones and permitting variable stone pressure.

At the beginning of the cycle the stone pressure is low, increasing as the surfaces become smoother. Four stones on each arm scrub away the surface irregularity, while a special lubricant washes away the removed particles. The six pin bearings of the ground shafts are brought down from a surface finish of 30 micro-in. rms. to a finish of less than 5 micro-in. rms. in 1.5 min.



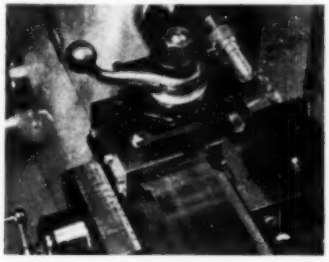
HORIZONTAL HYDRAULIC BENDING PRESS is offered by the R. D. Wood Co., c/o Harris D. McKinney Organization, 12 South 12th St., Philadelphia 7, Pa. The self-contained 30-ton bending press is designed for general shop work use in bending and straightening bars, rods, light structural sections and similar material. The work table is 3x4 ft. The size of the ram head and resistance head is 9x18 in. and increments of 4 in. from a minimum of 12 to a maximum of 36 in. are used for adjusting distances between these heads. The hydraulic power is supplied by a pump which has a displacement of 17.1 gpm. at 1000 psi.



### Model C Cyclograph Analyzer For Control, Sorting of Parts

The Model C Cyclograph is offered from J. W. Dice & Co., 191 River Road, Grand View-on-the-Hudson, New York. The analyzer is a portable instrument operating on the core-less principle for rapid and non-destructive metallurgical examination and sorting of metal parts.

The range of test frequencies available in the instrument varies from 2 to 200 kc. The Model C is adaptable to the checking or sorting of metal parts on the basis of analysis, structure, hardness, case depth, and in some cases stress concentration. It can be employed to trace internal stress changes, compare stresses at different levels, or measure stress in psi. by calculation.



### Automatic Indexing Square Turret For the Compound Slide of Lathes

An automatic indexing square turret has been announced by the Hardinge Bros. Inc., Anderson St., Elmira, N. Y. The turret can be applied directly to the toolpost T-slot of the compound slide of the Hardinge precision lathe. The turret takes four standard 5/16-in. sq. toolbits. Accurate indexing is accomplished through a hardened and precision ground tapered index pin which locates in matting hardened and precision ground stations. The turret indexes by movement of the ball-handled lever.

## BROACH MAINTENANCE OPERATIONS

### A RESHARPENING

Restoring cutting edges that have been dulled from normal use.

### B RECONDITIONING

1. Along with normal resharpening, it is often necessary to "recondition" broaches for correct cutting action. That is, "gum out" between the teeth when sharpening has reduced chip clearance beyond working limits.

2. After several sharpenings, and even gumming out, it is sometimes economical to "re-sink" the entire form on form tools.

### C SALVAGING

Broken broaches can often be returned to full production duty after salvaging operations. Broken shanks can be repaired by welding, broken teeth can be re-stepped in some cases, etc.

Another important phase of salvaging is the conversion of good broaches to do jobs other than that for which they were originally designed. If engineering or production changes prohibit the use of present broaching tools, perhaps they can be converted to do other operations.

Ever since we designed and made the first set of broaches at Detroit Broach, we have welcomed broaches that were returned to us for maintenance, whether resharpening, reconditioning or salvaging was required. It is just as important to us to keep broaches "on the job" as it is to design, make and deliver new ones. There are advantages to you, too!

To perform any one of the three broach maintenance operations—they're defined at the left—requires proper equipment, inspection facilities and knowledge of broach design. Every broach returned to us should naturally be accompanied by instructions from the customer. In the light of these instructions it will be inspected by one of our engineers. He determines whether or not it is advisable to repair the tool—sometimes it is most economical not to—and if it is advisable, designates what operations are required. These operations are then performed on equipment selected for that purpose—by men skilled in broach maintenance. Finally, the broach is inspected on the finest and most complete broach inspection equipment available . . . following the same detailed inspection procedure used on new broaches.

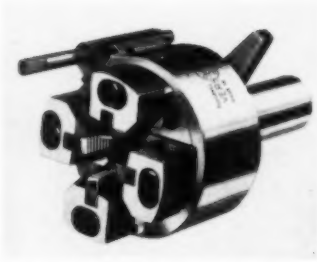
Many of our customers have always taken advantage of this service because it has proven to save them money. We suggest that you do, too . . . to guarantee the ultimate in broaching production at lowest over-all tool cost.

**DETROIT *Broach* COMPANY**

**20201 SHERWOOD AVE. DETROIT 12, MICH.**

### Magnetic Chuck with Rectifier Has a 5x10-in. Working Surface

The Hanchett Magna-Lock Corp., Big Rapids, Mich., offers a magnetic chuck and rectifier combination, suited for use on small machines and for bench work. Listed at the Magna-Lock HR-510-C, the chuck has the same laminated faceplate design as is used in the larger Magna-Lock models. The Model HR-510-C has a 5x10-in. working surface and is 4-in. high. It is furnished complete with separate rectifier and built-in switch. Work is held to extreme edges of faceplate.

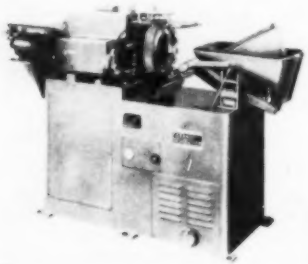


### Adjustable Blade Chaser Units For Threading, Hollow Milling

The National Acme Co., 170 E. 131st St., Cleveland 8, Ohio, offers the adjustable blade chaser used for limited-production lots of both threading and hollow milling work. Each unit, chaser, holder and slide, is interchangeable with Vers-o-tool-equipped circular chaser units normally used for long-run production.

The standard Namco micrometer gage is used to adjust the blade and holder to a predetermined setting on the slide according to the material being cut. Because of the adjustment-for-wear principle and the ¼-in. thickness of the chaser, the adjustable blade chasers get more pieces per grind per dollar investment.

Chasers and holders from ⅜- and 9/16-Brown and Sharpe sizes are interchangeable. The ⅜-in. head has one slide for a cutting range of 0 to 7/16 in.; the 9/16-in. head has two slides 0 to 7/16 in., and 29/64 to 11/16 in.

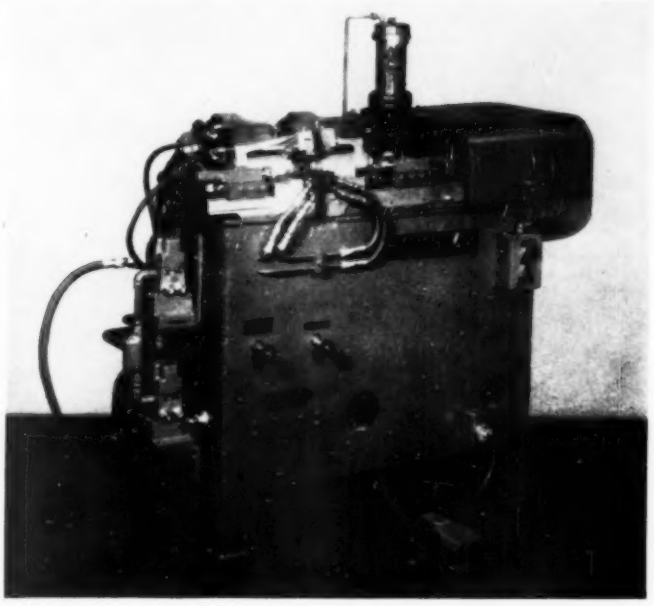


### Automatic Slug-Heating Machine Offers a Variable-Speed Drive

An automatic slug-heating machine is offered by Feedall Machine and Engineering Co., 70 Vine St., Willoughby, Ohio. The machine, when used with an induction heating unit becomes an automatic slug heater. The parts are dumped into the large hopper at the rear of the machine where they are fed to the transfer dial and then loaded into the inductor coil.

As each piece is delivered to the coil, another piece, ready for forging, is delivered at the front of the machine. The machine illustrated was tooled for heating slugs 1 in. in diameter by 1 in. long at the rate of approximately 20 per min.

The machine can be adjusted for different diameters and production speeds in proportion to the stock used. It is driven by a ½-hp. motor and is equipped with a variable-speed drive which can be adjusted while the machine is running. All transfer and pushing movements are air operated and can be adjusted by the operator when needed.



## Thomson Synchro-Matic Flash Welder Offers Pushbutton Automatic Control

The Thomson Synchro-Matic flash welder provides automatic control of flashing and upset with the entire welding sequence synchronized and reduced to a pushbutton process. The process is applicable to all standard as well as many other combinations of metals.

The machine is provided with settings and calibrated scales for upset in flash-off distances and for welding time. Values recommended or known to produce good welds are used to set up the machine and the work is clamped. Dimensions of the welded piece can be held to close limits and allowance for flash-off and upset can be held to a minimum.

Combinations normally considered impracticable such as copper-to-copper or copper-to-aluminum can be welded. It can also be used on bronzes, brasses, aluminum and magnesium alloys. Motive force for the movable platen is supplied by an air cylinder.

# DRAPER CORPORATION world's largest loom manufacturer

## LOWERS PRODUCTION COSTS WITH

# J & L COLD-FINISHED JALCASE STEEL

J&L STEEL

*Mr. Joseph Whalley holds a shuttle from a modern Draper high-speed rayon loom to show the Jalcase tips.—Demonstration Room in Draper Corporation's modern plant, Hopedale, Massachusetts.*

## Shuttle Tips* made of JALCASE last longer . . . are easier to machine and heat treat.

Most likely the fabric in your broadcloth or oxford shirt was woven on a Draper loom, because Draper Corporation is the world's largest manufacturer of cotton and rayon looms. —And on many of the shuttles in these famous looms, the tips are made from J&L COLD-FINISHED JALCASE, the *original* open-hearth free-machining steel.

These tips must withstand *millions* of blows from the "pickers" that send the shuttle flying back and forth across the loom as many as *225 times a minute*. The steel must have uniform heat-treating characteristics to produce tips with *hard* points, *soft* shoulders and *tough* stems. Besides, Draper wants a steel that machines freely to a smooth finish at high speeds, and a steel that conserves tool life. That's why Draper uses J&L COLD-FINISHED JALCASE. It reduces production costs!

Here is a steel that is practically "tailor-made" to your requirements. From the ten grades of JALCASE, you can select just the right properties that suit *your* manufacturing conditions best. The result is: Higher production . . . Longer tool life . . . A better product. No wonder that J&L COLD-FINISHED JALCASE has been the *leading free-machining steel* for more than 25 years!

We have just published a new booklet describing the ten grades of J&L COLD-FINISHED JALCASE Steel. Let us send you a copy. It's free. The coupon is for your convenience.

Jones & Laughlin Steel Corporation
402 Jones & Laughlin Building
Pittsburgh 19, Pennsylvania

Please send me your new booklet on J&L COLD-FINISHED JALCASE—the *original*, open-hearth, free-machining steel.

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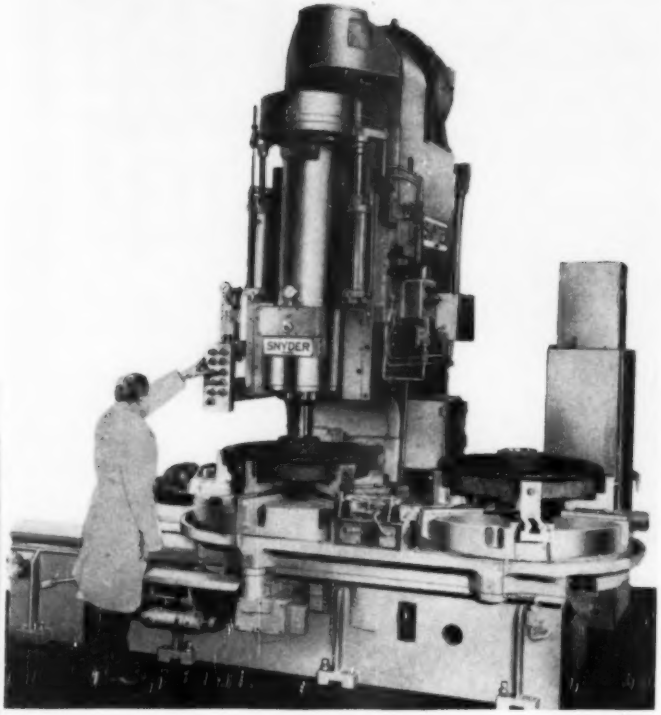
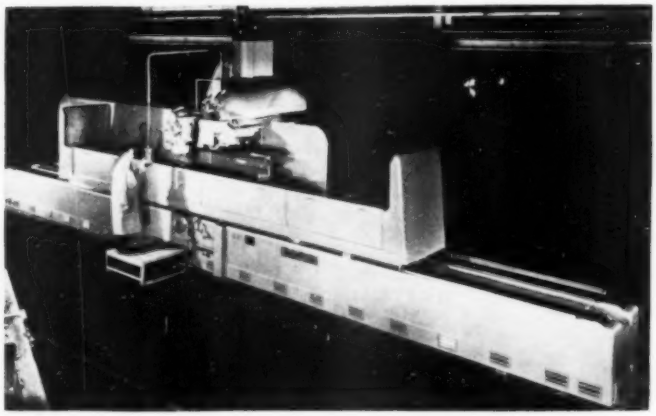
## JONES & LAUGHLIN STEEL CORPORATION

*From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in* OTISCOLOY *and* JALLOY *(hi-tensile steels).*

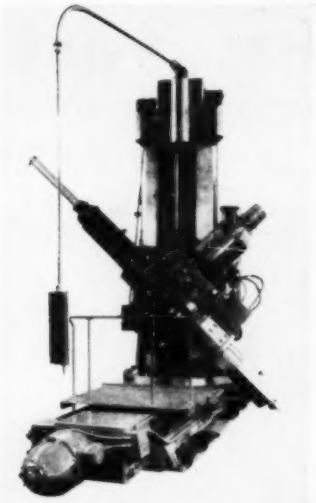
**PRINCIPAL PRODUCTS:** HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURALS AND PLATES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS




BORING machine for rough boring of railroad car wheels and similar large forgings and castings is offered by Snyder Tool & Engineering Co., East Lafayette, Detroit, Mich. A similar machine is available for finish-boring on any type of large casting or steel forging. Tungsten-carbide tools are used to remove 1 in. of stock from a 5¾-in. dia. pierced hole 7½ in. long in a steel car wheel. Cutting time is 55 sec. per wheel. Tool speeds range from 80 to 240 rpm. and feed speeds are infinite. Stroke is 14 in.



HEAVY-DUTY SURFACE GRINDERS are offered by Thompson Grinder Co., Springfield, Ohio. Listed as the Thompson heavy-duty Type CX, 30x48x196-in. hydraulic way grinder, the model illustrated has a giant 46-ft. bed length and was manufactured for a lathe manufacturer to grind the ways of its larger machines. The machine is equipped with auxiliary vertical spindle for grinding safety gib, clamp surfaces and rack seats on the machine bed.



## Universal Traveling-Head Planer For Shaping, Planing and Slotting

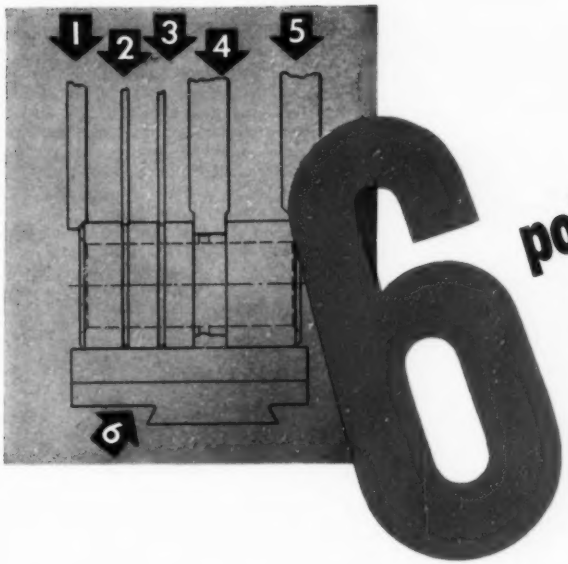
The universal traveling-head planer is arranged for shaping, planing and slotting only. Made by Morton Mfg. Co., Broadway and Hoyt, Muskegon Heights, Mich., the machine has a 65-in. length of cutting stroke with 48 in. of vertical feed on the column and a bed approximately 17 ft. long providing 10 ft. of horizontal travel.

The column will rotate 360° and the ram is adjustable 25° either way from the horizontal position. The standard draw-cut shaper head has 6 in. of hand feed and uses 1½x2-in. cutting tools. Alternating current, variable voltage motors, and control equipment are provided. A 9-sq.in. ram is utilized. A ram bearing surface of 60 in. is featured in the saddle. It can be equipped with Jib Crane with manual or electric hoist.

## Electrode for Cast Iron Permits Machinable Welds Without Preheat

The Eutectic Welding Alloys Corporation, 40 Worth St., New York 13, N. Y. offers the new EutecTrode 24/49 which features the 1949 formula Frigidarc flux coating. The electrode has been developed to produce strong bonds and high-tensile welds that are machinable through the weld and the weld zone on both gray and alloy cast iron without preheating.

The 5/32-in. electrode welds cast iron readily at 80 to 100 amp. It applies on either a.c. or d.c. with either straight or reverse polarity. The electrode is available in 3/32-, ⅛- and 5/32-in. diameters.




# 6 point savings in tools...

**WHEN THE TOOLS ARE TANTUNG**

## Tantung tools produced, in 6¾ hours, the work formerly requiring 13½ hours with high speed steel tools

Actual performance figures obtained in shops all over the country repeatedly prove Tantung superiority over high speed steel tools on jobs requiring increased production and tool life.

6 Tantung tools in a multiple tool set-up for grooving, chamfering, turning, facing and cut-off operations again pointed the way to doubled performance AT NO EXTRA COST!

For more pieces per grind at speeds and feeds above high speed steels and just below those of carbides your choice should be TANTUNG.

It's that extra speed and feed on your present equipment that means more profitable metal removing operations for you...and that extra speed and feed is obtained easily with TANTUNG.

Here's a multiple tool operation that enabled a mass production manufacturer to double his production at no extra cost.

**Performance Data**

| | |
|---|---|
| MACHINE: | Consomatic, 8 spindle. |
| PART: | Overdrive Stationary Gear. |
| MATERIAL: | S.A.E. 4042 (cold drawn). |
| OPERATION: | Grooving, chamfering, facing, turning and cut-off operations to close tolerances and fine finish. |

**Comparative Test Data**

| | TANTUNG | H.S.S. |
|---|---|---|
| Rev. Per. Min. | 305 | 230 |
| S.F.M. | 135 | 105 |
| Cycle Time | 24.5 sec. | 57.0 sec. |
| Pieces per grind | 1000 | 425 |
| Feed: Front slide | .0014 | .0006 |
| Back slide | .003 | .0015 |

For that extra added performance that means a greater margin of profitable operation with TANTUNG call your nearest V-R branch office TODAY! If you want increased production over high speed steel tools and are unable to use carbides because of equipment limitations TANTUNG is your answer.

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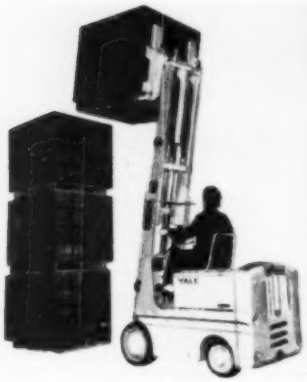
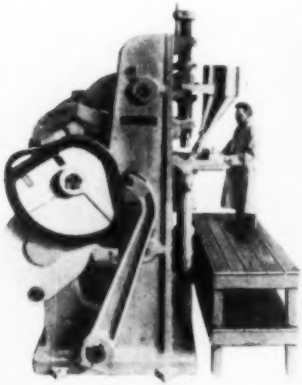


## Yale & Towne Gas Truck Line Offers Fluid Drive, Low Masts

The Yale & Towne Mfg. Co., Philadelphia, Pa., offers a gasoline-powered line of industrial trucks. The line, known as the Lift King, will feature fluid-drive automotive controls, hydraulic piston lift, and low mast heights.

The truck is equipped with standard Chrysler fluid drive. The fluid coupling permits the operator to progress from slow to fast speeds and vice-versa without operating the clutch or gear-shift levers. The hydraulic lift is actuated by a ram within a ram which gives two stages of elevation. It is constructed to permit a full 66-in. load-lift before the telescopic mechanism begins to rise. The gas truck offers lifting speeds of 30 fpm. at full load.



## Stokes Powder Metal Press Takes Pieces to 4-in. Dia.

The redesigned P-3 cam-type powder metal press is offered by F. J. Stokes Machine Co., 5900 Tabor Rd., Philadelphia 20, Pa. The improved press offers smoother action provided through the use of air cylinders in place of springs for holding rocker arms on both upper and lower cams, shaker cams, and core-rod cams.

The use of the twin-disk clutch and brake as standard equipment helps take the load off the motors since the flywheel is allowed to come up to full speed before the clutch engages. This also permits adjustment of punches and dies while flywheel is turning.

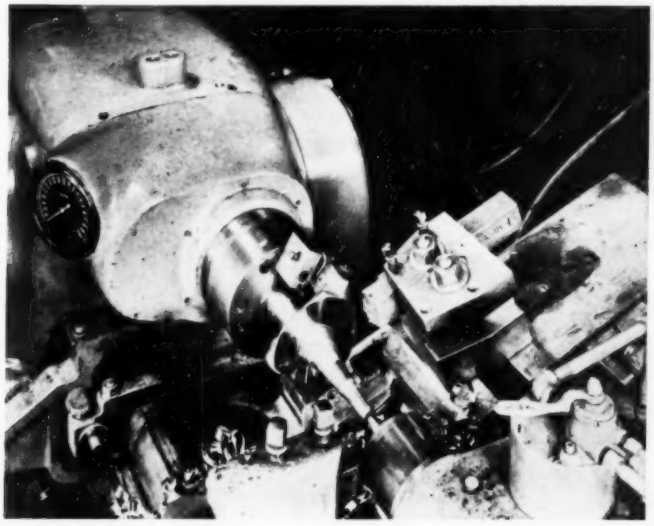
Press core rods have been strengthened to take up to 15 tons as a movable core rod, and 30 tons as a stationary core rod. The addition of a high slip motor, coupled with the heavier flywheel has permitted a reduced motor size. The improved press has a maximum depth of fill of 8 in. and a maximum diameter of piece of 4 in.

## B & S Surface Grinding Machines Offer Automatic Lubrication

The Nos. 2L and 2LB surface grinding machines made by Brown and Sharpe Manufacturing Co., Providence, R. I., offer automatic lubrication for all moving parts and surfaces. Table sliding surfaces are guarded from abrasive dust. The No. 2L machine has automatic feeds and the No. 2LB has hand feeds.

Both are offered with drive for motor in the base or with motorized spindle. The Model 2L grinds work to 18 in. long, 6 in. wide and 9½ in. high, using a wheel 7 in. in diameter. Vertical adjustment of the wheel spindle slide is 10 in. Maximum longitudinal travel of the table is 20 in. Maximum range of transverse movement is 6½ in. The worktable is 46x8 in. wide. Working surface is 18x6 in. Adjustable stops provide for any cross feed from 0.01 to 0.09 in. in either end of table travel. Machine takes straight wheels 7 in. in diameter by ½ in. thick with a 1¼-in. hole.

# SAVE WITH SINGLE-POINT TOOLING



## Air-gage trace it on the MONARCH MONA-MATIC

You can turn it faster, cheaper, more accurately—on an Air-Gage Tracer-equipped Mona-Matic.

Here's a typical example: forged steering knuckles finish machined in 1.23 minutes—*in one setup*. Performance like this is characteristic of Air-Gage Tracing—the exclusive Monarch method that provides single-point, automatic cycle metal turning for multiple diameter parts.

Expensive forming tools and complicated multiple tool setups are completely eliminated. There's practically no work distortion; the accuracy of this method often reduces *by half* the amount of grinding stock. You'll save on setup time, too—it almost never exceeds fifteen to twenty minutes. What's more, one man can operate two machines—*easily*.

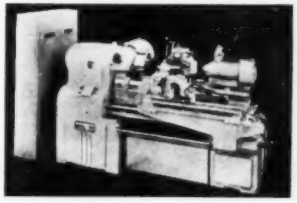
On the steering knuckle job illustrated, full advantage is taken of two optional *plus* features: the two-speed main drive motor permits shifting to half speed at any desired point in the cycle—to maintain finish as the tool moves out along the flange. The rear tool slide is timed to lead the front tool slide, performing a roughing cut on the flange to prolong the life of the front tool.

The second plus feature is the automatic feed change—providing up to five infinitely variable feeds, as required. This flexibility of operation allows maximum machining efficiency in the removal of variable stock, so characteristic of forgings.

The Mona-Matic method is adaptable to a vast variety of work-pieces; it has made spectacular savings on many a production line. May we show you how it can help lower your own costs?

### JOB FACTS

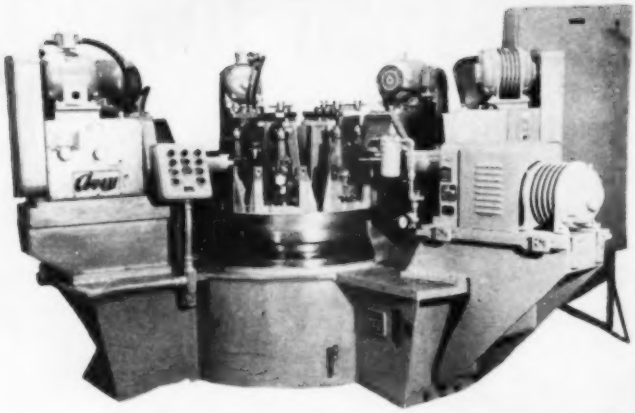
Part—Steering Knuckle
Material—SAE 3135 forging
Operations Performed—Turn stem complete; face flange
Cutting Tool—Carbide Insert
Tolerance—± .001"
Total Machining Time—1.23 minutes
*Note—Two pieces are produced in the above time, as one man operates two machines.*



**THE MONARCH MACHINE TOOL COMPANY • Sidney, Ohio**

ACCURACY · ECONOMY · LONG LIFE
Monarch
TURNING MACHINES

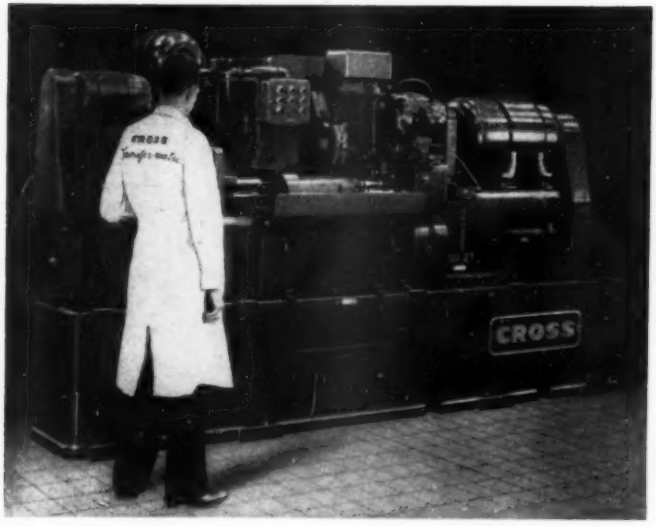
**FOR A GOOD TURN *FASTER*—TURN TO MONARCH**



## Avey Drilling and Tapping Machines Feature an Automatic Indexing Table

The Avey Drilling Machine Co., Cincinnati 1, Ohio, offers two automatic-index drilling and tapping machines. The machine incorporates 5, No. 2 Avey cam-feed units, plus a U.S. leadscrew tapping unit, all mounted horizontally around a seven-station automatic-indexing table. Mounted on the table are seven quick-acting hard-clamping fixtures.

The machine performs multiple drilling, reaming, and tapping operations on automotive over-drive housings. Production is estimated at 180 parts per hour. Built on fabricated steel bases, each machine has a 36-in. index table with automatic sweep removal of chips.



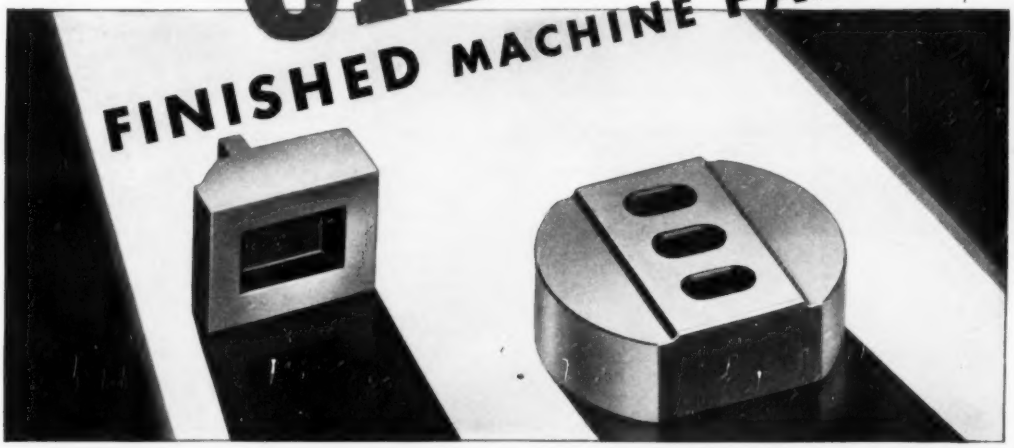

FINISHING MACHINE for oil-pump bodies is offered by Cross Co., Detroit 7, Mich. Operations which are performed at 63 pieces per hr. include milling both ends, drilling two mounting holes on the left end, drilling and tapping four cover holes on the right end, drilling and reaming two bearing holes, roughing and semi-finishing two gear pockets, and forming a pressure relief cavity. The machine cuts 9 pieces at a time progressively

HOISTER is offered by Lewis-Shepard Products, Inc., Watertown, Mass. The Type DH Handy Hoister is a light lifter for raising and lowering all kinds of loads to 500-lb. capacity. Crank-up crank-down operation through planetary gear-drive winch permits placing and holding platform at any level. One revolution of the winch handle gives full 3-in. lift. The hoist has a 24x24-in. lifting platform, a 5½-in. lowered height, and 58-in. lifting height, is 72 in. over-all in height and has 5-in.-dia. wheels at front and rear

## GE Offers Combination Watthour And Thermal Watt Demand Meter

A single-phase combination watthour and thermal watt demand meter is offered by General Electric's Meter and Instrument Division, Schenectady 5, N. Y. Listed as the Type IHM-1, the meter is housed in a case slightly larger than that required by conventional watthour meter. It can be installed wherever rate structures require the determination of demand as well as energy, without increasing the size of the original installation.

# No TOOLING Program with OILITE FINISHED MACHINE PARTS



## *Finished to Precision Tolerances—No Machining*

Eliminating tooling programs will save capital investment, time, floor space, and expense.
With OILITE, Engineers and manufacturers enjoy a NEW freedom of design.
Parts impossible to machine economically can often be made readily, by OILITE powder metallurgy.
OILITE Machine Parts are applicable to mass production.
Note the depression and elliptical bores in the parts shown above.

*ADDITIONAL ADVANTAGES OF OILITE METAL POWDER UNITS ARE:*

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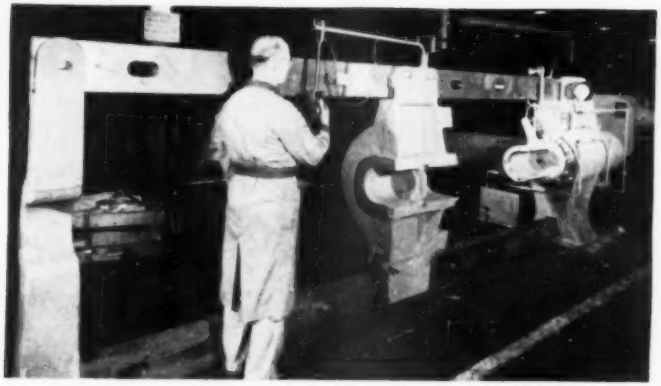
*Division of Chrysler Corporation*

FIELD ENGINEERS AND SUPPLY DEPOTS IN PRINCIPAL CITIES



HYDRAULIC WHEEL PRESSES with capacities from 50 to 600 tons are offered by the Hydraulic Press Mfg. Co., Mt. Gilead, Ohio. The line of self-contained presses are offered for assembling or removing wheels, pulleys, gears and similar work. A typical size has a 48-in. clearance between bars, 128-in. maximum daylight, and a 24-in. ram travel. The power unit consists of a variable-delivery oil hydraulic pump with direct electric motor drive

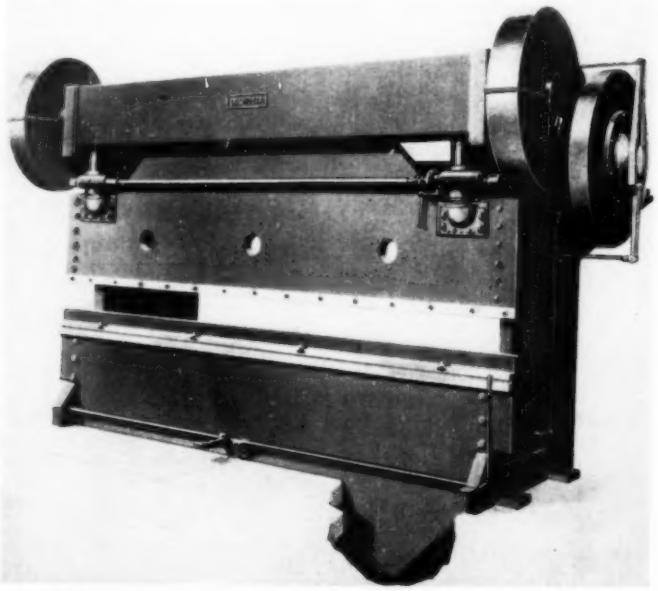
VARIABLE - SPEED TRANSMISSIONS are offered by the Graham Transmissions, Inc., 3754 N. Holton St., Milwaukee 12, Wis. The Model 41MW, illustrated, offers built-in motor and built-in worm reducer. It is available in ratios of reduction of 5 to 1, 12 to 1, 18 to 1, 27 to 1, and 54 to 1. The gear box can be fastened to the transmission housing to give horizontal position of the low-speed shaft either to right or left; or the output shaft may project vertically either upward or downward. The models are available from 1/25 to 1 hp.

### GE Line of ac. Magnetic Starters Starts, Protects Motors to 50 hp.

A line of ac. magnetic starters is offered by the General Electric Co., Schenectady 5, N. Y. Designed for starting and protecting motors up to 50 hp., the new full-voltage starters are furnished in all NEMA sizes from 0 to 3. The contactors can be furnished in NEMA sizes from 00 through 3.

A one-piece plastic-encased coil inclosure protects the windings against dirt, moisture, or possible damage during installation. The clamp-type coil terminals are firmly embedded in this inclosure to prevent loosening.

Self-lubricated vertical slots in the sides of this inclosure permit the magnet armature guides to move quietly and smoothly. The starters are furnished either open or mounted in general-purpose watertight, dust-tight, or hazardous atmosphere inclosures.



## Power Press Brakes Are Offered In Sizes from 120 to 900 Tons

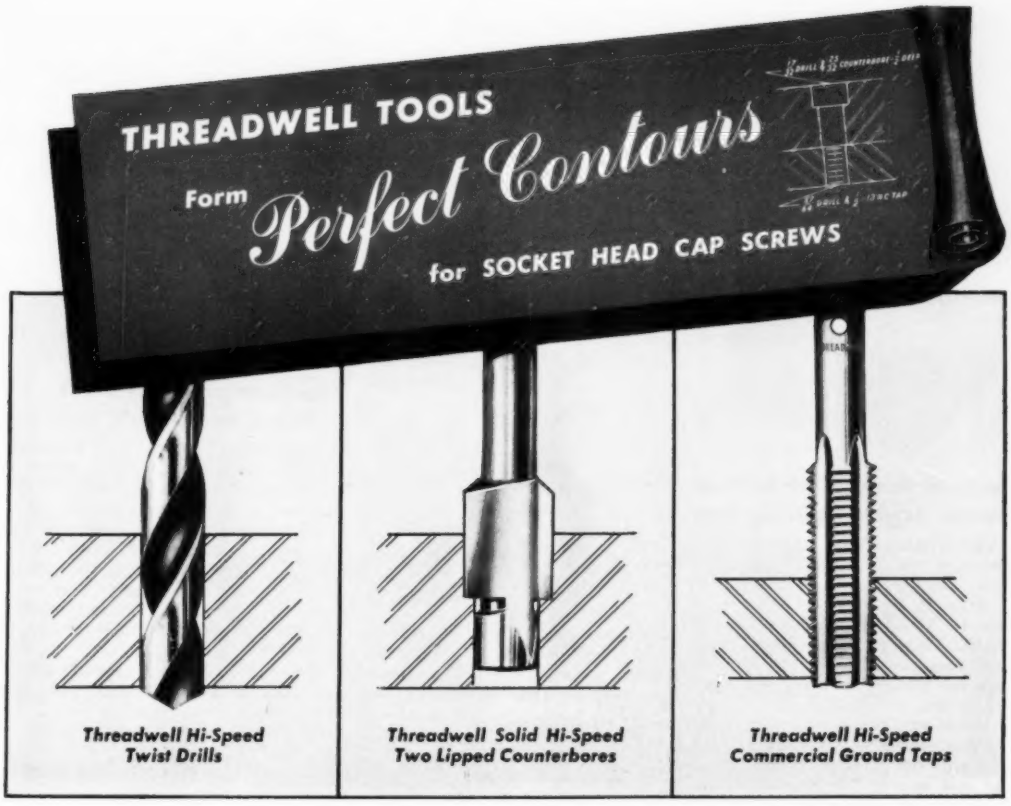
Columbia Machinery and Engineering Corp., Hamilton, Ohio, offers power press brakes to include a complete range of sizes from 120 to 900 tons. Models are available for forming mild steel 1/8 in. to 1 in. thick in lengths from 4 to 20 ft.

All sizes except the 120-ton model now employ twin-drive main gears. All models have motor-driven slide adjustments with micrometer controls.

Standard bending and forming dies, die blocks and toolholders can be furnished and all models can be equipped with removable wide tables for use with wide dies or special punching setups.

# THREADWELL TOOLS

Form *Perfect Contours* for SOCKET HEAD CAP SCREWS



***Threadwell Hi-Speed Twist Drills***

***Threadwell Solid Hi-Speed Two Lipped Counterbores***

***Threadwell Hi-Speed Commercial Ground Taps***

The contour for this cap screw was made by a 17/32 drill and 25/32 counterbore ½ deep in the holding piece, and 27/64 drill and ½-13 NC tap in the held piece. Result: A perfect fastening job through the teamwork of Threadwell Tools.

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Even the most exacting jobs can be started and finished with Threadwell's complete line of cutting tools. Each step of the operation can be done by the same high quality tools, assuring the same precise degree of accuracy for the whole job. You can't afford to overlook Threadwell Tools. Write for catalog now!

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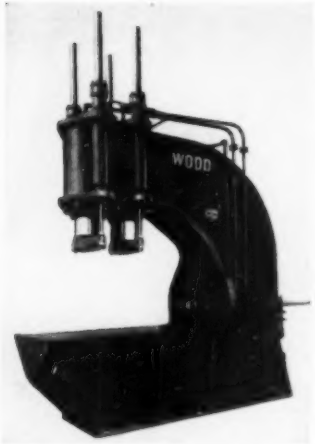



## Sectional Flanging Press by Wood Handles Joggling, Upsetting Work

A press designed for use in sectional flanging operations can be used also for joggling and upsetting work. Offered by R. D. Wood Co., c/o Harris D. McKinney Organization, 12 South 12th St., Philadelphia 7, Pa., the press has a 200-ton capacity with the two vertical main rams operated in unison. Its capacity with a single vertical ram is 100 tons.

The horizontal ram with a 72-ton capacity has a detachable cross-head of cast open-hearth steel with bore and tapered key slot for attachment of tooling. Designs for this hydraulic press are available from 150 to 300 tons with larger sizes available for special requirements.

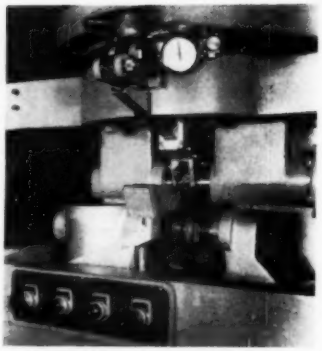
## Portable Electric Polisher Features a Vertical Spindle

A 10-in. vertical-type portable electric polisher is offered as part of the Metalmaster line of portable electric tools, offered by the Bradford Machine Tool Co., Cincinnati, Ohio. Listed as the Model 109 polisher, it is designed particularly for automotive work, enabling the operator to reach into difficult places encountered in auto-body polishing.

The polisher is driven with a universal ac.-dc. 110-v. motor, 25-60 cycles, 5.5 amps at 1000-rpm. free speed; 700-rpm. load speed. The net weight of the tool is 10 lb. Accessories furnished include one 9-in. backing pad, one 10-in. lamb's wool bonnet, and 15 ft. of rubber-covered three-conductor cable.

TRANSRIDER STACKER is designed with a driver's seat. The Transrider stacker is designed to bridge the gap between motorized hand-truck and fork-truck operations, and is offered by the Automatic Transportation Co., 149 West 87th St., Chicago, Ill. It can be used as a fork truck of the same capacity. The telescopic lift mechanism extends to 130 in. despite having an over-all height of 83 in. for clearance through standard factory and box-car doors. Capacity is 2000 lb. with a 48-in. load, 2500 lb. with a 36-in. load, and 3000 lb. with a 28-in. load

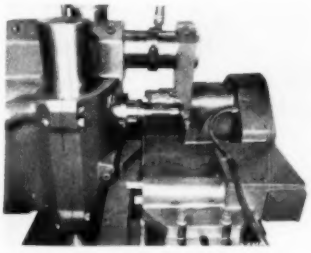
LOAD CARRIER, JR. is offered by Market Forge Co., Everett, Mass. The truck is 30 in. wide with 60-in. length of loading space between end racks. The over-all length is 63⅝ in. The truck has a maximum capacity of 2500-lb. distributed load. It is furnished in tilt type, non-tilt type, wagon type and dolly type, and can be furnished with 4-, 6-, and 8-in. wheels



## Semi-Automatic Gaging Device Offered for Automatic Loaders

The Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich., offers a semi-automatic gaging device in addition to its automatic loaders for gear finishing machines. The device which is mounted at the loading end of the chute leading into the machine consists of two gears used to gage the pinions being furnished and mounted so that they can revolve freely.

The center distance between the two gaging gears is such that a pinion with an oversize pitch diameter, or one with the stock in excess for best shaving results will not drop through between the gears into the chute.



## Milling Machine by Kent-Owens Offers Automatic Index Fixture

Kent-Owens Machine Co., Toledo, Ohio, offers the 2-20 milling machine arranged with an automatic index fixture and all necessary tooling for milling irregularly spaced vent slots in piston rings. A group of rings are mounted on an adaptor which is placed in the fixture and the table feed is then engaged. The balance of the operation including milling and indexing is automatic. The machine has a 42x12-in. table with 20-in. table travel. Twelve spindle speeds range from 64 rpm. to 860 rpm.

# EASIEST OF ALL SHEARS TO OPERATE

"EASIEST of all Shears to operate" are not just our words. They are words of operators being heard with increasing frequency as more Steelweld Shears are placed in plants throughout the country.

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As a result Steelweld Shears are radically different with advantages never before possible.

Whether or not you are in need of a shear at this time, if you work plate in any thickness up to 1¼-inch or length to 18 feet, we urge you to get more data on these modern machines. Keep informed — send for the catalog below.

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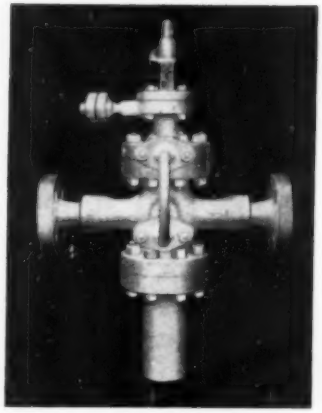
# Parts and Materials



### High-Pressure Reducing Valve For Steam, Air or Gas Service

The Leslie Company, 129 Delafield Ave., Lyndhurst, N. J., offers a high-pressure reducing valve employing an internal-pilot piston-operated construction. The valve, listed as Class HS is designed for steam, air or gas service. It handles inlet steam pressures from 300 to 1500 psi. and air or gas inlet pressures from 300 to 3000 psi. The reduced pressure range is from 100 to 600 psi. Maximum inlet temperature is 1000 F.

The valve is available in sizes of 1, 1¼, 1½ and 2 in. with Series 90 or 150 flanges or welding ends. No change of spring or diaphragm is needed from minimum to maximum reduced pressure setting.

### Iridite Bright Dip Offered For Automatic Zinc Plating

The Allied Research Products, Inc., 4004 E. Monument St., Baltimore 5, Md., offers the new Iridite Bright dip designed for use in automatic zinc-plating installations. A variation of the standard Iridite Bright, the new dip makes possible a bright chromate coating using as few as three stations after plating: rinse, Iridite, and rinse, followed by the usual drying methods.

The degree of brightness and corrosion resistance can be controlled by the operator. Nitric acid is used along with an equal part of Iridite Bright concentrate, to replenish the working solution and keep the pH at proper operating levels. Cost figures under production conditions are ranging from $0.0015 to $0.002 per sq. ft. of surface treated.

**NUT, for fastener applications where temperature ranges from —65 F. to 1200 F., is offered by the Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J. These fasteners are all self locking and provide permanent protection against vibration, impact and stress reversal in both fully seated and position settings**

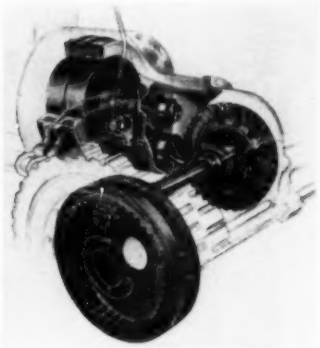
### Pre-treatment and Primer for Metal Gives Hard, Paintable Foundation

The Wilbur and Williams Co., Greenlead and Leon Sts., Boston 15, Mass., offers Rust-O-Primer, a vinyl-base quick-drying wet primer, applicable over wet or dry, clean or rusted metal, including steel, aluminum or galvanizing. Its purpose is to provide a hard paintable foundation for any type of paint including ship-bottom paints as well as acid-caustibond vinyl type of finish.

### Room-Temperature Strippers Offered for Organic Finishes

Enthone Inc., 442 Elm St., Dept. AM, New Haven, Conn., offers two room-temperature strippers for synthetic enamels, Stripper S-17 and Stripper S-19. Stripper S-17 is stated to be a clear quick-evaporating stripper used at room temperature for removal of all types of synthetic enamels. It is recommended for the removal of clear synthetic enamels from highly polished surfaces such as brass, gold plate and silver.

Stripper S-19 is similar to Stripper S-17 in its action and appearance except it is slightly ammoniacal in composition and is used in certain special cases for removal of enamels.



### Clark Magnetic Induction Drive For Fork Truck Eliminates Clutch

The Clark Dynatork drive is offered by Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich. Power from the truck's engine is transmitted by means of magnetic induction. Two magnetic coils are mounted within the flywheel and are surrounded by magnetic poles. They rotate with the flywheel and are the driving members—one coil for forward, and one for reverse.

The magnetic inductive force is applied through an air gap and as a result there is no metal-to-metal contact between driving and driven members. A selector-switch on the steering column provides finger-tip control of the truck movement.

Since there is no metal-to-metal contact between driving and driven members with a magnetic induction force being applied through an air gap, there is no need for the conventional clutch.

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**COSTLY TIE-UPS**
like this . . .

when you can
**STOP DELAYS . . .**

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It's far more economical to equip your plant with enough Black & Decker 6" Standard Bench Grinders . . . than to have workers waiting in line, trying to make too few Bench Grinders do the job! When you spot these handy Bench Grinders at strategic points, the savings in man-hours alone more than pays their low cost. And you'll speed up tool sharpening . . . "run-of-shop" grinding . . . a whole raft of cleaning jobs!

Black & Decker 6" Standard Bench Grinders are economical to buy . . . economical to use . . . sturdy, well-balanced tools with many practical features you wouldn't expect to find at such a low price. Order these low-cost Bench Grinders from your nearby Black & Decker Distributor today. Call him today and break up those costly, time-wasting grinding "bottlenecks" in your shop! Write for your free copy of our catalog to: The Black & Decker Mfg. Co., 616 Pennsylvania Ave., Towson 4, Md.

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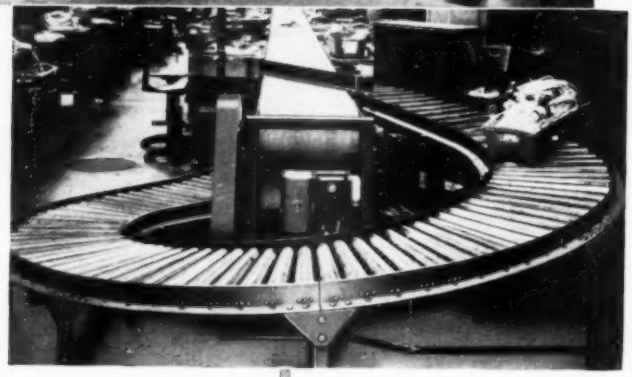

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# ROUND TABLE Discussion

## TOO GOOD

The question as to whether a top-speed worker can upset the equilibrium of his shopmates resolves itself into another: Does an operator working with zealous fervor—suffering under the delusion of piles of work produced—contribute to a healthy state in a well-organized shop? While there are physical or mental conditions present in a super-worker, necessitating that he concentrate unusually while on the job and enabling him to turn out an unusual amount of work, do these unnatural spurts of Superman constitute sound, lasting accomplishment?

When a foreman, egotistic or otherwise, falls heir to one of these hell-raising go-getters, his blood pressure tends to go up because of the eventual reflection on his own productive adroitness. It may be assumed that shopmates will try to compete with the fast man—that the environmental effect will result in greater effort on their part—but self-preservation causes them to throw up the sponge, as it were, in resigned futility. They know that the "atom bomb" in their midst will eventually explode and, as an aftermath of the destructive force which is entirely unnatural, that that which remains is rather difficult to rebuild.

John Homewood
Ontario, Calif.

•

## GOOD MORNING TO YOU

The success of a day's effort is materially dependent upon conditions prevailing at the beginning. We are all prone to arise in the morning with a grouch, now and then, and if it so happens that we are in such a position as to affect others it is certainly not going to do any good to pass it on.

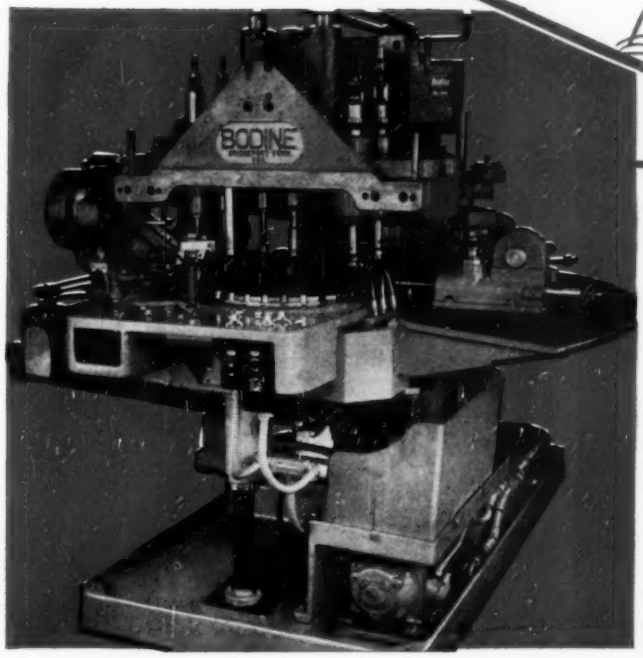
Even though one cannot shed his off-feeling in the early morning, he should, for sound business reasons, put on a false front at least until the healing power of time has had a chance to straighten him up.

It takes only a few minutes to make the rounds the first thing in the morning and spread that necessary ray of sunshine in greeting men. That smile is the foundation for the day and it reaps dividends —both for the giver and the given.

*Here's where*

# "THINKING IN CIRCLES"

## *means* Substantial Savings



The center of actvity in a Bodine automatic Multiple Spindle Milling, Drilling, Tapping and Screw Inserting machine is around the circle of the horizontal indexing table. Small components are carried to working stations where tools are located to operate vertically, horizontally, diagonally or even from an inverted position. Thus a great variety of tooling combinations may be arranged . . . for high speed cost-cutting production.

For instance, one manufacturer reports that a battery of sixteen Bodine's shows a saving over previous production methods of up to $200.00 per day for each machine.

We suggest that you permit our engineers to do some "thinking in circles" for you . . . to provide the exactly right machine and tooling for your specific job. There's inspiration for production executives in the new Bodine Bulletin . . . **send for your copy today.**

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The selection of alloy steel grades necessarily varies with each manufacturer's needs and opinions. Some prefer HY-TEN alloy steel, while others recommend standard A. I. S. I. steel. However, differences in choice need not mean different sources of supply . . . just contact the Wheelock, Lovejoy warehouse nearest you. There you will find all grades of HY-TEN alloy steel as well as standard A. I. S. I. . . . grades to meet every need and opinion. By dealing with Wheelock, Lovejoy, you have the advantage of prompt delivery from a nearby source, plus courteous help from men who know metallurgy.

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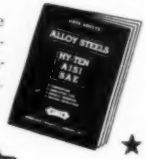
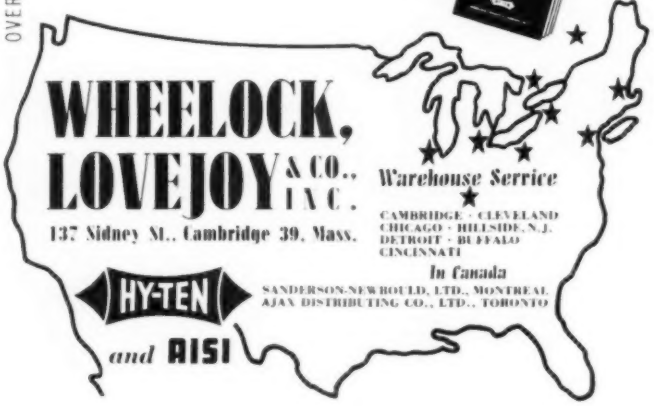

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HY-TEN and AISI

"You are what you eat," said some sage with a gastronomical complex. I, being a liberal as well as a Republican (paradox!) will paraphrase that with another: "You are what you give out."

Once you have cemented the day's efforts with a good, cheery start, you can go on for the rest of the day with intrepid courage and, with a clear conscience in lots of cases, raise particular hell with impunity. One of my educator confederates who, during the first World War, was assigned to duty in a railroad shop in France. "Oh, John," he confided to me one day when we were discussing shop courtesy, "You should have been with me in Paris in '18 and seen the shop superintendent as he came around every morning—he'd greet each man with a gracious bow and a sincere smile."

"What! No kisses?" I asked.

"Not exactly," he replied, and then he let out with a laugh as he continued. "But! ye gods! Later in the day when anything went wrong he would call the straw boss and raise the roof; then he would call the subforeman and take the shingles off with his ravings; then, to clinch his displeasure on their minds he would, with gestures peculiar to a Frenchman's anger, stamp his feet like a monkey on a stick and, finally leaving the guilty parties, he would indicate his extreme displeasure by yanking at his badly abused hair."

It's a small world! They do it in France, so why not in the good, old United States? Smile when a smile will reap untold rewards, and raise particular hell when the bluedevils make it necessary at a later hour.

John Homewood
Ontario, Calif.

•

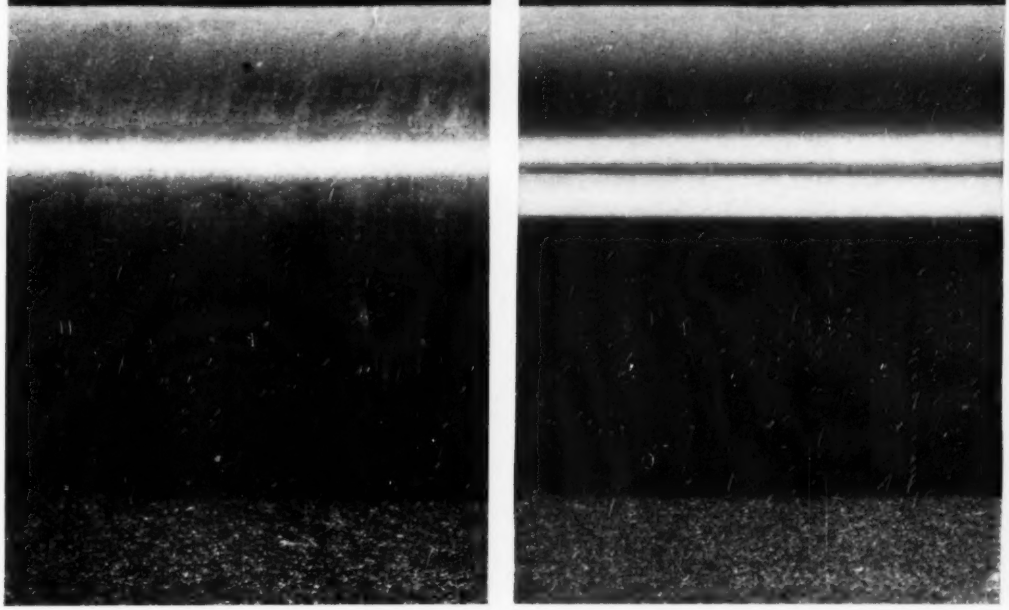
Having the foreman walk past the men every morning with a dead pan and a "Garumph" is the best reason I know of for a man to pack up his tools and leave. If the employer enters his plant with springy step, a big smile, and says, "Good morning" to each employee he encounters as if he meant it, the foremen will soon imitate him.

This business of "breakfast-table grouches" or "hangovers" are just poor excuses for not doing the proper thing. Once a man develops the habit of treating everyone with a hearty greeting every morning, it will overcome all other feelings.

One employer I had the pleasure of working for had this habit, and his appearance every morning started the wheels rolling. He had just as many "hangovers" as any one

# TABLE "JUMP" STOPPED

**BY THE WORLD'S GREATEST LUBRICATION KNOWLEDGE**



The correct oil on table ways can make a terrific difference. The photo left shows surface mars on the workpiece caused by faulty lubrication. Photo right shows precise finish obtained with an improved lubricant.

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**Backed by Skilled Engineering Service**

No more table "jumps" to mar precise finishes produced by grinders, millers, boring machines, lathes and other machines. Vastly improved way lubricants developed by Socony-Vacuum take care of this production bugbear. These special oils assure smooth table movement when you're working at slow traverse speeds, or where the table must come to a precise stop. They also provide smooth starting, even after the table has been idle for some time. For performance facts . . . and correct application to your needs . . . see your Socony-Vacuum Representative.

SOCONY-VACUUM

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC.
and Affiliates: MAGNOLIA PETROLEUM CO.
GENERAL PETROLEUM CORPORATION

*Rely on* **SOCONY-VACUUM** *Correct Lubrication*

CLARK

Another Clark user writes an ad!

"OUR FORK TRUCK SAVED US A NEW WAREHOUSE"

*"By doubling the capacity of our warehouse our Clark fork truck saved us the heavy capital expense of enlarging that facility," says a gratifying unsolicited letter from A. S. Marlow, Jr., head of MARLOW PUMPS, Ridgewood, N. J. "In one year the machine paid for itself several times over from reduced costs; and to date there has been no down-time or maintenance expense."*

This is typical of many letters from users in every conceivable kind of business, warmly endorsing Clark fork-lift trucks and towing tractors. For helpful data on how your business may enjoy similar or even greater benefits from these versatile machines, we urge you to CONSULT CLARK.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS AND INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIV., CLARK EQUIPMENT COMPANY BATTLE CREEK 3, MICH.
REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE WORLD
AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

else, but he never failed us. Even the day he came in with a fever of 102, no one suspected he had the grippe, or the time he had three teeth pulled, he still smiled and sang out, "Good morning."

Al mentions that by greeting the men and putting on a smile, he shakes off his grouch. The men reciprocate by forgetting their troubles and handling their work with a free mind. This is the more important feature of this simple gesture. The employer isn't interested in a man's personal troubles; he wants production. If his foreman can get the men to put their troubles aside and tackle the boss' problems of making money he is earning his salary.

Many concerns spend large sums of money to develop labor relations and overlook this "gratis" method.

Frank J. Zarnowski
Rutherford, N. J.

•

## FACE-TO-FACE OR BACK-TO-BACK

One of the finest-principled employers I have ever worked for used to gather his men together periodically and have what he liked to term his "gripe session," in which each would let his hair down, as the women say, and get one or more things off his chest. To his way of thinking, this eliminated any possible spontaneous combustion usually caused by improper ventilation (failure to bring things out in the open). No go-between could possibly have satisfied the men as much as he did. "Old Ironsides"—as I'll call him for convenience—would lay his cards on the table—a term he liked to use—and talk turkey with an open honesty that the men could not misconstrue. Every man who worked with him—he insisted "with" be used instead of "for"—had the highest respect and love for his straightforwardness.

If at all possible, in a reasonably small plant, the direct contact between employer and employee should be considered. It possesses a greater "cementing" effect than it would were the big boss to remain aloof and let a representative handle affairs for him. A substitute is never as weathering. There isn't the sincerity of purpose that would exist were the head in evidence at the table. Any lieutenant is likely to have his own interest at heart and be inclined to evade or stretch matters so the genuine harmonious result will not be forthcoming.

To augment the effectiveness of his straight-from-the-shoulder talks, Old Ironsides took great pleasure in

# AN OIL PAN EVERY *Ten Seconds!*

## Another H-P-M production record with less than 1% scrap!

Things really began to "pop" when a prominent mid-western stamping company installed a 750-ton H-P-M deep drawing press. Here's their story on the production of automotive oil pans.

—**350 oil pans per hour!**

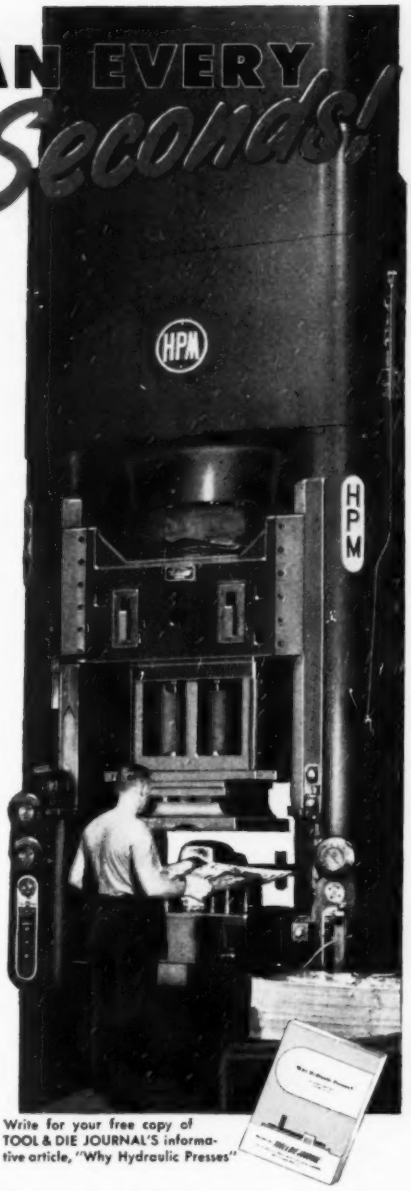
—**Scrap loss was cut from 3½ to *less than 1%!***

—**Drawing operations were *reduced* on one job from *2* to *1!***

This H-P-M press owner is also "going to town" on many new production opportunities opened up by this versatile H-P-M hydraulic! A typical job is a tank drawn from ¼" thick steel stock.

This is not the only plant where H-P-M hydraulics have done a real job. H-P-M's constant drawing speed . . . smooth, fast operation . . . shockless reversal . . . positive overload protection . . . quick die set-up make it possible to put your toughest metal working jobs in the profit column. Call in a nearby H-P-M engineer to analyze your specific parts production. We may be able to *save you real money!* There's no obligation. Write today!

**THE HYDRAULIC PRESS MFG. COMPANY**
**1002 Marion Road Mount Gilead, Ohio, U.S.A.**

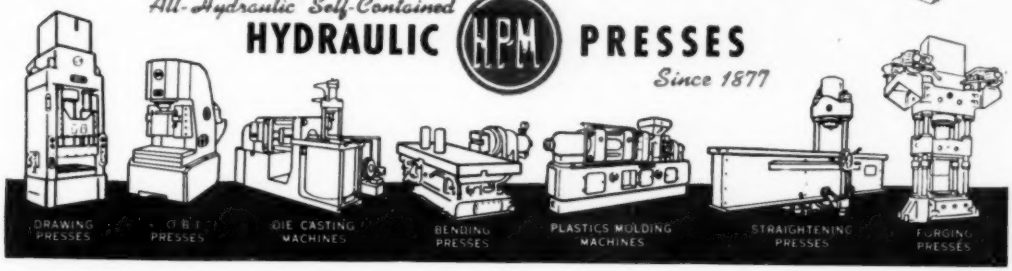



Write for your free copy of TOOL & DIE JOURNAL'S informative article, "Why Hydraulic Presses"

*All-Hydraulic Self-Contained*

**HYDRAULIC HPM PRESSES**

*Since 1877*



# HERE'S HOW...

## PRODUCTION WAS INCREASED 40%

## costly lab treated taps produced 15,000 threaded holes per tap

## HY-PRO ENGINEERING cut tap costs and increased production to 21,000

**PART:** Pressed steel tubular nut.

**PROBLEM:** A leading special products manufacturer was tapping with a 5/16 – 18 spiral point tap to a depth of 3/4" full thread in tough, stringy steel. To average 15,000 holes per tap, many required lapping to size and all were specially surface treated. A costly, time-consuming process for the user.

*Then they called in a Hy-Pro Engineer.*

**HY-PRO SOLUTION:** He recommended a Hy-Pro quality controlled 5/16 – 18 spiral point tap with an exclusive Hy-Pro surface treatment that provides longer wear and proper lubrication. Production now consistently runs 21,000 threaded holes per Hy-Pro tap — *and* they are used without modification.

Above is a typical example of how the Hy-Pro Sales Engineer can help increase threaded-hole production. His expert engineering counsel backed by the most up-to-date tap production methods combine to solve tapping problems rapidly and profitably.

All Hy-Pro Taps are ground from tough uniform quality high-speed steel and given one of the Hy-Pro exclusive surface treatments.

Each tap is completely inspected by the latest electronic quality control equipment, your assurance that there will be no dimensional variance in Hy-Pro Taps of a stated size.

These precision manufacturing methods plus the ability of the Hy-Pro Sales Engineer to prescribe the correct tap for your particular job means *sustained accuracy* on your production line resulting in higher productivity from your tapping machines.

Let Hy-Pro solve your tapping problem—call a Hy-Pro Sales Engineer today.

*Order from your distributor.*

HY-PRO TAPS

HY-PRO TOOL CO.

NEW BEDFORD, MASSACHUSETTS

A SUBSIDIARY OF CONTINENTAL SCREW COMPANY


his annual get-togethers at Christmas time. This holiday gathering was the big occasion of the year in which the giving of good-sized bonus checks was followed by parched tonsils receiving their yearly alcotherapy. If there were any complaints, just or unjust, on the minds of the employees when they entered the festive parlor gaily festooned with Yuletide trimmings, there positively were none when the feather-headed celebrants went back to their various duties several hours later.

Old Ironsides undoubtedly was a master in industrial relations. His final touch in cooperative efficiency went in such high gear that the happy employees—gloriously happy, satisfied men—were unanimous in their conclusions that the old man was, without the shadow of a doubt, the peer of them all—the "bes' ol' f-fe-fella wash ish."

John Homewood
Ontario, Calif.

•

### REST FOR THE WEARY?

In 1912 I was employed in a large plant into which a new department superintendent came. A few days after he arrived, he ordered all boxes and stools removed from the machine shop. This was done at night and the stools were even removed from foremen's desks. All of us had been accustomed to sitting on stools while our machines took the cut, so when the men arrived in the morning and saw what had happened, they called a meeting. No one started work and a delegation was chosen to go and see him.

He was quite willing to discuss the matter, and stools were restored on milling, drilling and inspection, but not in the lathe section. He refused to budge on that point. He felt as Ed does that stools are only in the way at a lathe and give the section a slovenly look. They also, in his opinion, tempt a man to take longer than necessary to complete a job. He also said: "Don't misunderstand me. If I were working in that section, I probably would sit down like you fellows. But even so, it isn't efficient and it isn't in the best interest of you or the company."

It has been proved time and time again that men are more alert and wide awake if they stand to work at a lathe. Also, seated men clutter the passageway between lathe rows and interfere with both production and materials handling.

But when Ed says you will only get a couple of objections if stools were removed, he is barking up the wrong tree. The stools are already

# We were Proud of this GEARGRIND 30 Years Ago!

At that time it represented ten years of progress in the art of Formed Wheel Grinding, whereby gears and splines were ground after hardening by means of an accurately formed grinding wheel. The contour of the grinding wheel was maintained by frequent dressing, using a special Geargrind wheel trimmer.

TYPE
GG-10 x 48A

## BUT PRESENT MODELS EARN *More Money for You!*

About the only resemblance between today's GEARGRIND and its predecessors is the principle involved.

On the GG-10 x 48A shown above tooth spacing is controlled by a precision ground master index plate. The work reciprocates past the grinding wheel on a short stroke—just long enough to clear the wheel—and at each reversal point the grinding wheel feeds down. After grinding on one tooth space until a "rough size" is reached, the work is automatically indexed and the next tooth space is ground.

After a predetermined number of teeth have been ground the dresser automatically moves into position to true the grinding wheel. Once the roughing is complete the work is finish ground in the conventional manner, indexing automatically from tooth to tooth.

This method of grinding is 3 to 4 times faster than by any previous machine of comparable capacity, and the many automatic features permit one man to operate more than one machine.

## FEATURES

- Automatic grinding wheel feed
- Automatic wheel feed for truing
- Automatically cushioned trim position
- Automatic lubrication of ways
- Double column support for grinding wheel head
- Axial grinding wheel spindle adjustment
- High work table speeds
- Control panel with interlocked safety features and highly accessible push button and other control
- Index head spindle mounted on tapered roller bearings

The GEAR GRINDING MACHINE COMPANY
DETROIT 11, MICH. U.S.A.

*Write for Information Today!*

**Lovejoy Type "A"** milling cutters are unsurpassed for removing metal quickly, accurately and smoothly. And a big PLUS feature is blade design—H.S.S., carbide and cast alloy blades are interchangeable in any Lovejoy Type "A" housing ever built—from 4½" to 42" in diameter! No need to carry a large stock of blades because Lovejoy gives immediate delivery from its own large stock.

Another asset is Lovejoy's exclusive "positive-locking" device. This means that a minimum of stock must be removed when sharpening blades. It allows use of a large percentage of each blade. It holds blades immovably even during heavy intermittent cuts.

The Lovejoy man near you will be pleased to give details and production estimates on your own work.

**"TOOL BITS"**

*Type "A" face mills are available for all standard arbor mounts (National and Lovejoy) and standard spindle mounts (National, Ingersoll, Universal, Giddings & Lewis and Lucas). Details will be found in Lovejoy Catalog No. 28. If you have unusual jobs requiring special cutter designs, call on Lovejoy the "specialists on specials."*

Lovejoy
TOOL COMPANY, INC.
SPRINGFIELD, VERMONT

*Write for Catalog No. 28*


there, and most of the men would kick even if they do not use the stools continuously on the ground that it was a breach of their rights.

I believe that stools should be provided for lathe hands on heavy manufacturing lathes where cuts take anywhere from an hour or two up to several days to complete. But they should not be available at small lathes and toolroom lathes, unless work comes along that is so intricate and specialized, that the seated worker can do a better job. I think the foreman can use his head in the matter and supply seats when seats are indicated.

Arthur Silvester
Niantic, Conn.

•

## TALK OR SWEAT FIRST?

The opportune time to control infiltration of undesirable elements into the shop is presented when a new employee comes in. Not only is the psychological approach of help in orienting a new employee, but a personal and informative chat helps to send the man off to a good start and gives the foreman an insight on the man's mental processes and leanings. To insure the successful outcome of the personal chat, the foreman should always remember the old axiom—"to impress people favorably, let them impress you."

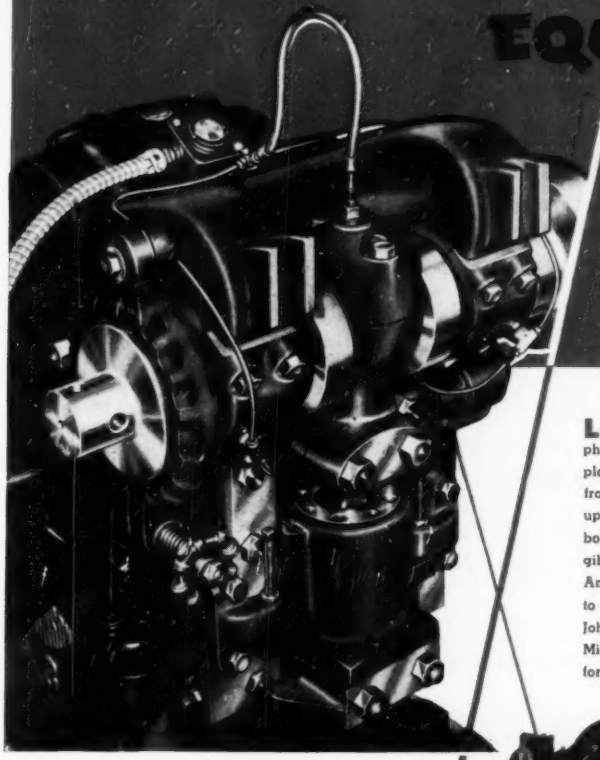
"Rubbing a man's nose in the job" has proved detrimental to the employee's understanding of the effective handling of his position and the efficient performance of his duties.

Of course, the worker is hired to work, not to talk. But while work is important, it should not be forgotten that an entire stranger needs some "diplomatic checking" before he can be considered a dependable employee. An espionage system is not proposed, but a confidential chat with a new man will give the foreman a chance to know him better. Also, the personal approach will engender confidence in each other on the part of both foreman and worker.

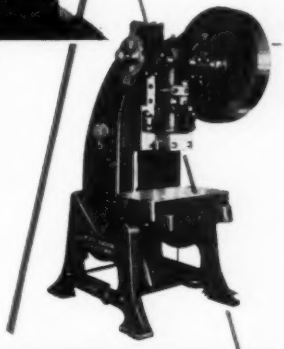
One of the best tests of a good foreman is the way he breaks-in newcomers. The traditional reception an old-line boss gives a new man is to look him up and down, spit on the floor, and say, "Well, here's the job, let's see if you can handle it." Then he keeps a hawk-like eye on the newcomer, and seems to enjoy calling him on every mistake. The resultant increase in spoiled work and labor turnover is sufficient refutation of the value of this method of handling new men.

# IF YOU FAVOR RUGGED EQUIPMENT,

## PUT INCLINABLE JOHNSON POWER PRESSES IN YOUR PLANT



**LOOK INTO** this stripped-down press photographed on the assembly floor at the Johnson plant. Judge for yourself what that cast semi-steel frame will take. See how the crankshaft measures up with other presses of similar rated tonnage at bottom of stroke. Consider Johnson's extra-long gibs that mean years of service on heavier jobs. And when it gets going . . . we'd need a movie to show the smooth action, of course . . . you'll find Johnson precision manifested in every working part. Might be worth your while to write Johnson, asking for a tip on nearby installations of our presses.



### EXTRA SAFETY ONLY JOHNSON CAN OFFER

is a feature of every press we build. The exclusive patented Non-Repeating Safety Clutch protects workers and equipment, yet it is simple in its operation. Two activating springs work to hold trip lever in disengaged position. If one of two springs breaks, the other takes over. Should both fail, the clutch automatically disengages. Springs are easily replaced in 30 seconds without stopping machine.

### MORE DIE SPACE

on all models from 16 to 90 ton capacity gives you a PRODUCTION BONUS. Johnson presses do more die work per dollar, make it possible to contract for a wider range of jobs without increased investment. For special heavy duty, Johnson builds an extra-thick bolster plate to stand the gaff . . . interchangeable with the standard bolster for ordinary production requirements.

***Write*** **or call Johnson for FREE CATALOG of the six models of Inclinable Power Presses now being offered. Get Johnson's ideas for more work from presses, too.**

**Johnson MACHINE and PRESS CORP.**

[redacted]

COMPLETELY **NEW**
CASE HARDENING PROCESS

**Carburit**

ULTRA RAPID PACK HARDENING PASTE

HIGH RAPIDITY OF PENETRATION
*.040" in 25 to 30 Minutes*

SOLVES PROBLEM OF SELECTIVE HARDENING
*by applying only to desired sections*

NO SPECIAL FURNACES OR EQUIPMENT NEEDED
*—even an open fire will suffice*

ENORMOUS TIME SAVING
*— repair units can be hardened right in maintenance shop. No special training required*

CARBURIT IS NON-TOXIC

**Isopac**

ISOLATING PASTE

KEEPS DESIRED SECTIONS SOFT

*While rest of workpiece is being hardened*

REPLACES COPPER PLATING—
*and other expensive methods.*

JUST PUT ON AND KNOCK OFF
*Saves time, money.*

PREVENTS PENETRATION OF CARBON AND SLOWS DOWN COOLING OF COVERED SECTION.

NO SHRINKING OR CRACKING

*Guaranteed Results*

*Send for completely descriptive circular*

**DENFIS** *Chemical Laboratories Inc.*

172 PACIFIC ST. (Phone UL 5-5295) BROOKLYN 2, N.Y.

*For Increased Efficiency*

THE **KALAMAZOO** *Metal Cutting* **BAND SAW**

**SPEED**

**ACCURACY**

**SIMPLICITY**

Cuts off rods, bars, tubes or odd shapes to lengths faster as cutting is continuous. Precision cutting with minimum waste of metal. Sets up quickly and easily—cuts and stops automatically. Large throat (8" x 16")—handles 95% of all jobs.

A low cost tool that pays for itself in STEPPED UP production. Wet Model (illustrated) for continuous cutting or Dry Model for occasional cutting.

*Ask for Bulletin or see your dealer.*

**MACHINE TOOL DIVISION**

**KALAMAZOO TANK & SILO CO., Kalamazoo 16, Michigan**

*Exclusive Export Distributors* **American Steel Export Co., New York City**

A good foreman, in contrast, realizes the agonies any man goes through in trying to adjust himself to a new job in a new company. (Think back on your own breaking-in periods.) He knows that a newcomer does not want to ask questions, for fear of appearing stupid. When a new man comes, he gives him a friendly welcome, guides him around the plant, explains what the whole operation is all about, and makes him feel at home. The foreman also takes this opportune time to gain the confidence of the new man to sound him out on his personal ideas and ideals.

Courteous and careful consideration of the new man will gain his confidence and lead him to "open up" to the foreman along the line the foreman is interested. The foreman usually earns or loses the loyalty of his men by the way he treats them while they are green, at the time when they are hungry for a friend. The first impression on a new man is apt to stay with him. He not only sizes up the foreman when he begins the job, but he passes judgment on the company by the initial treatment he receives.

Each person may have to be treated in a different manner, and in a way which seems to best fit the case and to best draw him out. The employment office in its initial interview is able to secure much pertinent data and information on the man's experience, education and family status. But it is the foreman who is closest to the new man and has greater opportunity for winning his confidence and inducing the man to act in a wholly natural manner, and "open up" in conversation.

New men are bound to be expensive. How expensive they are depends upon how they are broken in. If a new man is left to himself to pick up the job as best he can with little instruction from the foreman, he will be a very expensive man for the company. A new man will cost the least when he is carefully broken in and taught to do his work the right way first. Unless a new man is carefully instructed, he will spoil material. The best time to impress a man with the importance of quality workmanship is when he starts to work. Quality should be given priority over quantity because the new man should first learn to do his work right.

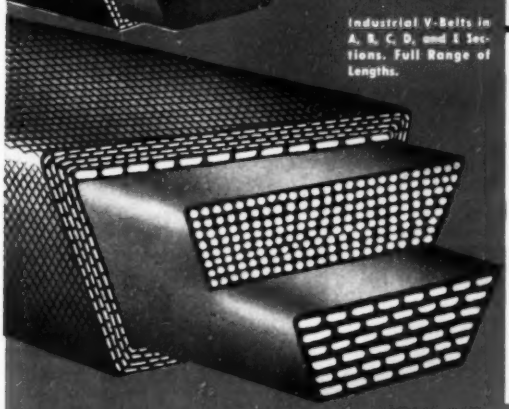
The function of employment does not end with acceptance of the worker by the Employment Department, and with his acceptance of the job. One of the best ways of having

What Engineers ask about

# *New* BULL DOG V-BELTS

for use in metalworking industry

Fractional Horsepower (FHP) V-Belts in Three Standard Sections. Full Range of Lengths.



Industrial V-Belts in A, B, C, D, and E Sections. Full Range of Lengths.

BWH

DEPENDABLE RUGGEDNESS

## why do new BULL DOG V-BELTS have less slippage?

Exclusive BULL DOG CORDS are processed in a new way, which results in amazingly low stretch. As a result, there's less slippage, fewer adjustments, longer belt life.

## why do new BULL DOG V-BELTS carry heavy power loads for longer periods?

Exclusive BULL DOG CORD SECTION has higher tensile strength. This enables Bull Dog V-Belts to absorb the shock of sudden starts and stops, to run smoothly months on end.

## why do new BULL DOG V-BELTS run cool and resist flexing?

BWH laboratories developed new quality-controlled compounds for Bull Dog V-Belts. Tests prove they run cool, don't crack or deteriorate under severe flexing.

## why do we say new BULL DOG V-BELTS have proved their dependability?

Like all BWH products, Bull Dog V-Belts are put through the stiffest laboratory tests. But that's only the beginning! For ten years they've been given field tests under terrific hazards. Their performance proves they've got the stuff it takes for steady, trouble-free power transmission. And since their introduction in 1948, leading industries everywhere have found this newest addition to the famous BWH line fully upholds the BWH reputation for products of dependable ruggedness.

Another Quality Product of

**BOSTON WOVEN HOSE & RUBBER COMPANY**

Distributors in all principal cities

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# PRODUCTION MARKING

**faster • better • cheaper**

Whatever you make Noblewest can mark permanently—faster—better—at lower cost. Typical is Noblewest Model 275 vertical dial Rapid Precision Marking Machine. Shown tooled for *marking and grooving* telephone wire splicing tubes, it does these two jobs in one operation at the rate of 125 pieces per minute. Simple gravity feed and unloading are both automatic and foolproof. The inscription is *permanently rolled in*—lasts as long as the product itself. Send for copy of our latest catalog "Modern Metal Marking Methods," or better still, let our engineers make recommendations for your specific requirements. *Write Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.*

MARK IT BEST WITH NOBLEWEST

NOBLEWEST IMPROVED MARKING DEVICES

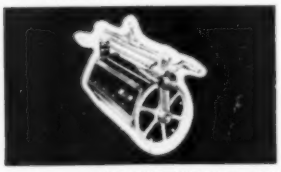
## *"What's so good about H-VW-M mercil type PLATING BARRELS?"*

GEORGE B. KNECHT
District Manager
H-VW-M Connecticut Office

"I like this frequently asked question. It gives us a chance to stress the economies of H-VW-M plating barrels. Our new Merlon cylinder, for instance, withstands high acid and alkali concentration and high temperature, permits loading plating cylinder and processing it directly through entire cleaning and plating cycle, eliminates the usual transfer of work load from cleaning baskets or monel cylinder to plating cylinder. Results are high speed production . . . low handling cost.

"We also discuss our various types of cathode contacts which meet any kind of load condition . . . our unobstructed cylinder for bulky pieces . . . our contact to stir up dense work loads . . . all adds up to high current efficiency. Then we point out H-VW-M's practical development for the constant replacement of plating solution in the cylinder, which means constant solution balance, consequently lower solution maintenance cost and a more uniform deposit.

"Our Plating Barrel Bulletin PB-107 covers this subject specifically. Write for your copy . . . and if you wish we'll be glad to discuss your problems personally at any time."



**Hanson-Van Winkle-Munning has supplied the plating industry for over 70 years. Our sales-engineers are thoroughly familiar with every step in the process of electroplating and polishing. It is this *overall* knowledge that has made H-VW-M "Headquarters" for electroplating and polishing equipment, supplies and technical assistance.**

**HANSON-VAN WINKLE-MUNNING COMPANY**
**MATAWAN, NEW JERSEY**
*Manufacturers of a complete line of electroplating and polishing equipment and supplies*
*Plants:* Matawan, New Jersey • Anderson, Indiana
*Sales Offices:* Anderson • Chicago • Cleveland • Dayton • Detroit
Grand Rapids • Matawan • Milwaukee • New Haven • New York • Philadelphia
Pittsburgh • Rochester • Springfield (Mass.) • Stratford (Conn.) • Utica


a new worker become dissatisfied with plant conditions is to have him not understand them. If the new worker is started to work without any adequate explanation of the aims and policies of the concern, is it surprising that he cannot readily be gotten to listen to tales of the "real aims of the plant?" It is, therefore, desirable that he be given a bird's-eye view of the plant, its policies and aims, and be shown his connection to all this. This is where the foreman has his job all cut out for him.

If he has the knack of winning cooperation and fostering teamwork he will readily assume the responsibility for diplomatically guiding the new man in the right direction. Most men work better and more efficiently under intelligent direction and authority. They work more happily too. As long as they are guided, provided only that the guidance is pleasant, they are content. A good foreman will make certain that the new man has the right make-up and proper slant, which, under his intelligent guidance, will fuse with the efforts of the group in pulling together for the common good of all.

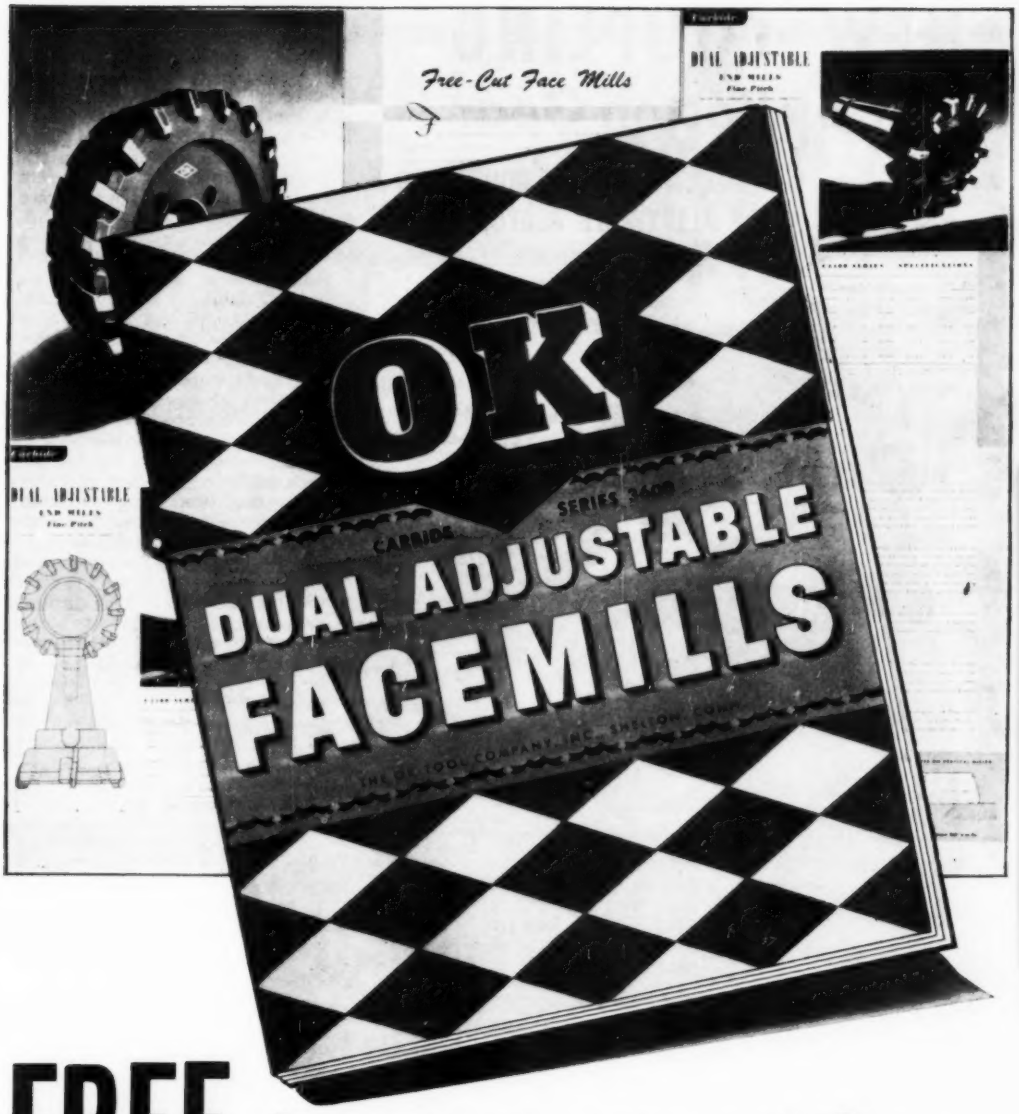
Harry Kaufman
Philadelphia 26, Pa.

•

Al has the right idea. When a new man starts working he should be introduced and the job should be explained to him. He should be shown around the shop and introduced to his fellow workers, and the foreman should have several chats with him about other things than the plant, without making it appear obvious. Many times such conversations will bring out the man's strong points and his weaknesses, and will enable the foreman to handle him more successfully to the man's and company's ultimate benefit.

Such things as men with chips on their shoulders, family sickness, money troubles and the like will interfere with production, and the foreman can often do something to help. What's more, he can determine from such chats whether or not the man is ambitious, and if so can help him on his way up the line. It is also possible in such chats to learn whether a man is doing the job for which he is best suited. After all we must all work together in order to get the most successful production, and anything the foreman does to help create this situation, will work out to the benefit of everyone concerned.

Michael Axler
New York 30, N. Y.




# FREE—important new catalog

**OK TOOL 3600 CARBIDE DUAL ADJUSTABLE FACE MILLS, END MILLS, SHELL END MILLS**

**First Showing of the new FREE CUT FACE MILLS**

These new cutters incorporate a combination of angles to obtain desired chamfer or lead angles for new high speeds and feeds. Fill out and mail coupon without obligation. THE O. K. TOOL CO., INC., Shelton, Conn.

THE O. K. TOOL COMPANY, INC.
SHELTON, CONN.

*Please send OK Face Mills Catalog 36.*

NAME .....

FIRM .....

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CITY ..... STATE .....

# NEW COUPLING
## by Boston Gear

**"BE SURE YOUR NEXT COUPLINGS HAVE ALL THESE FEATURES . . ."**

"Simple, accurately machined three-piece construction"
"Special oil-resistant synthetic rubber insert for quiet, flexible operation"
BOSTON
BOSTON
"Equipped with standard keyways and set screws"
"Available for shaft diameters from ¾" to 1¼"

**BRAND NEW DESIGN . . .** These new Boston Gear Couplings are designed for quick, simple installation and long, trouble-free service without attention. Completely, accurately machined, they are intended for a wide range of industrial applications where *flexibility, ruggedness* and *durability* are required. These couplings require no lubrication and are not harmed by oil, dust or dirt.

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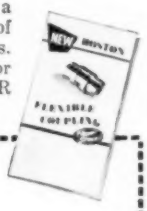


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### FOREMAN OR REFORMING?

Would not the answer to this question depend upon the normal duties of a foreman? Primarily, a foreman is expected to have knowledge of the work to be done by the workmen for whom he is responsible, and to supervise this so effectively that its quality and quantity are satisfactory. He who can do this, and induce team spirit at the same time, may be said to fill the bill.

If he can do more than this, he becomes valuable; he may indicate thereby that this additional capacity fits him for other and more important work. Unless any extra duties are closely connected with the normal work of supervision, the wisdom of their specification or encouragement is open to question.

One foreman was a top-hole jig designer; he was so fond of it that his normal work was neglected. Now, company relations has no affinity, technical or productive, with that of supervision. The appropriate information is not normally open to the foreman, and any time spent in its pursuit would, perforce, be at the expense of his duty of supervision.

If a company communique has to be read to workmen, and the desirability of this is clear, it ought to be read by an official who can explain or enlarge if need be, and answer questions thereon. The official would have access to the information on which the statement is based. Failing this, the reader will act as a parrot, not understanding the import of what he is reading. Surely this would tend to indicate that the company did not itself treat the matter seriously.

J. E. Powell
Lindum, England

## NEW BOOKS

PROCESS ENGINEERING—*By William H. Schutt, president, William H. Schutt Associates. Published by The McGraw-Hill Book Company, 330 West 42nd St., New York 18, N. Y. 310 pages. $4.*

The author considers it the function of the process engineer to determine directly from the blueprint the best sequence of operations, the tools and fixtures needed, the type of machinery required, and the correct estimated cost, for manufacturing any article. He then shows how anyone thoroughly familiar with time and motion study and blueprint reading

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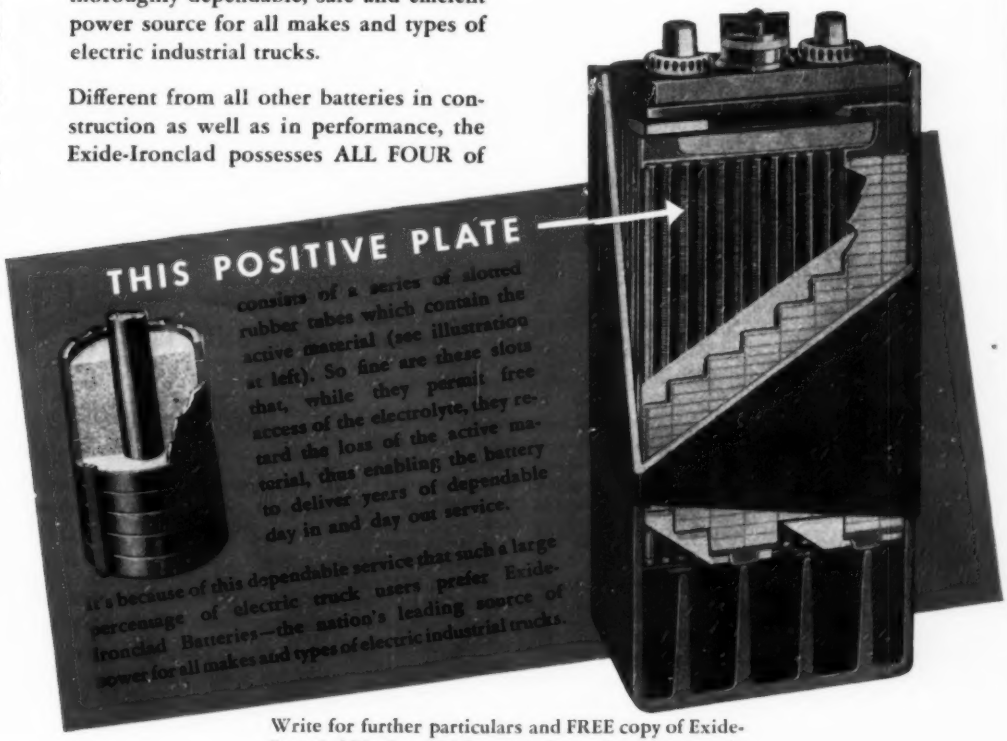
THIS POSITIVE PLATE
consists of a series of slotted rubber tubes which contain the active material (see illustration at left). So fine are these slots that, while they permit free access of the electrolyte, they retard the loss of the active material, thus enabling the battery to deliver years of dependable day in and day out service.
It's because of this dependable service that such a large percentage of electric truck users prefer Exide-Ironclad Batteries—the nation's leading source of power for all makes and types of electric industrial trucks.

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•

MACHINE DESIGN DRAWING ROOM PROBLEMS — *By C. D. Albert, professor of machine design, emeritus, Cornell University. Published by John Wiley & Sons, Inc., New York, N. Y. 511 pages. Price $5.*

This is the fourth edition of a standard book. Most of the old chapters have been revised and those on worm gearing and allowable stresses have been rewritten.

The processes of designing machines are illustrated by the solutions to 16 practical design problems. There are tables of standard machine data, properties of materials and mathematical constants Illustrations are generally line drawings, although some photographs are included.

•

MATHEMATICS AT WORK—*By Holbrook L. Horton. Published by The Industrial Press, New York. N. Y. 728 pages. Price $6.*

With the large number of mathematics texts available today, an author could only justify a new one by writing it so as to be practical to people outside the classrooms. This Mr. Horton has done.

Grouped according to the theories involved, some hundreds of problems are outlined, worked out and illustrated in relation to actual shop equipment. A few of these touch on such brow-wrinkling subjects as tapers, gears, bearing loads and torque. A section in the front of the book includes a brief review of arithmetic, algebra, geometry, trigonometry and logarithms. Another section in the back contains 146 pages of common tables useful to anyone who uses mathematics.

Probably the best market for this book lies in the engineering and drafting field where the basic prin-


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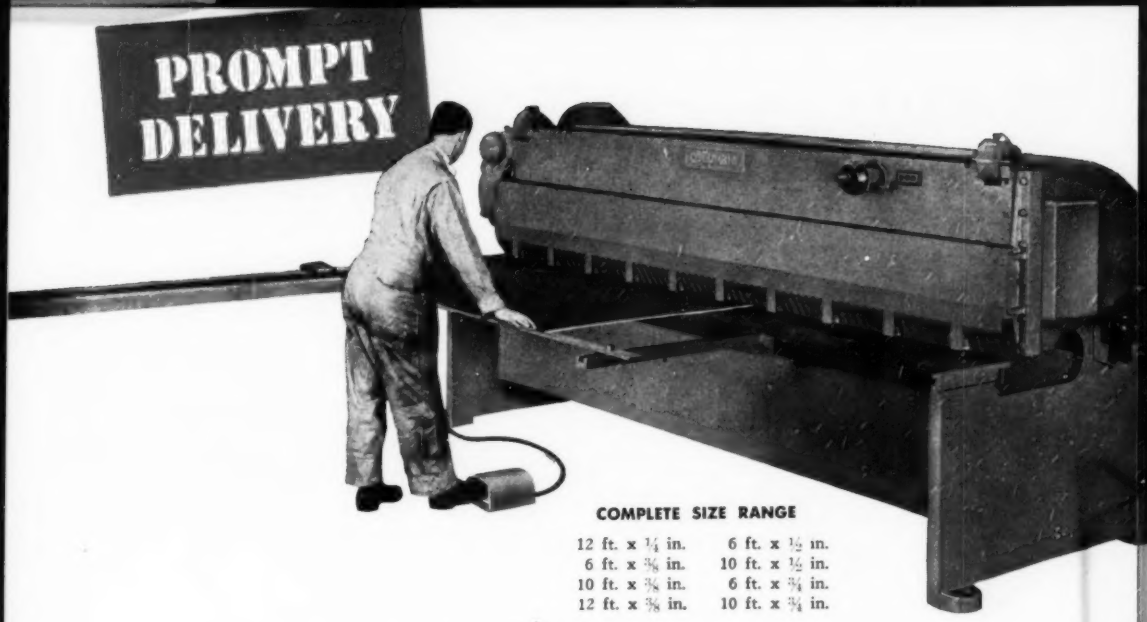


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ciples involved in solving unusual problems or those that are not usually encountered in the daily routine have been long forgotten or were never fully understood. The book would probably not be acceptable for formal classroom work since it teaches almost exclusively by example, but it should be a good reference for engineering and shop calculations.

•

MOTION AND TIME STUDY—*By Ralph M. Barnes, professor of industrial engineering and director of personnel, College of Engineering, University of Iowa. Published by John Wiley & Son, Inc., 440 Fourth Ave., New York 16, N. Y. 560 pages. Price $5.*

In this new third edition, the contents of the previous edition have been revised and additional material has been supplied. Two new appendices outline how to set up a work-methods training program, covering a preview to management requiring a minimum time of presentation of two to three hours and the main program to be presented to operating personnel in the manufacturing sections, estimated to require 30 to 40 hours. Five new chapters are devoted to the following topics: process analysis, gang process charts, activity charts, and man and machine charts. Also incorporated are the findings of a survey conducted by the author in 80 factories to determine the most successful motion and time study techniques.

•

PRODUCTION CONTROL—*By Lawrence L. Bethel, director, New Haven YMCA Junior College; Walter L. Tann, chief production engineer, Bureau of Ordnance, Navy Dept.; Franklin T. Atwater, industrial engineering manager, Fafnir Bearing Co.; and Edward E. Rung, production control manager, U. S. Rubber Co., Footwear Div. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. 290 pages. Price $3.50.*

The new second edition of this well-known book is an extensive revision to include developments in production control since the early years of the Second World War when the first edition was written. Throughout the text, the subject is presented in terms of the current concept in industrial organizations that regards production control as a part of an integrated series of controls and

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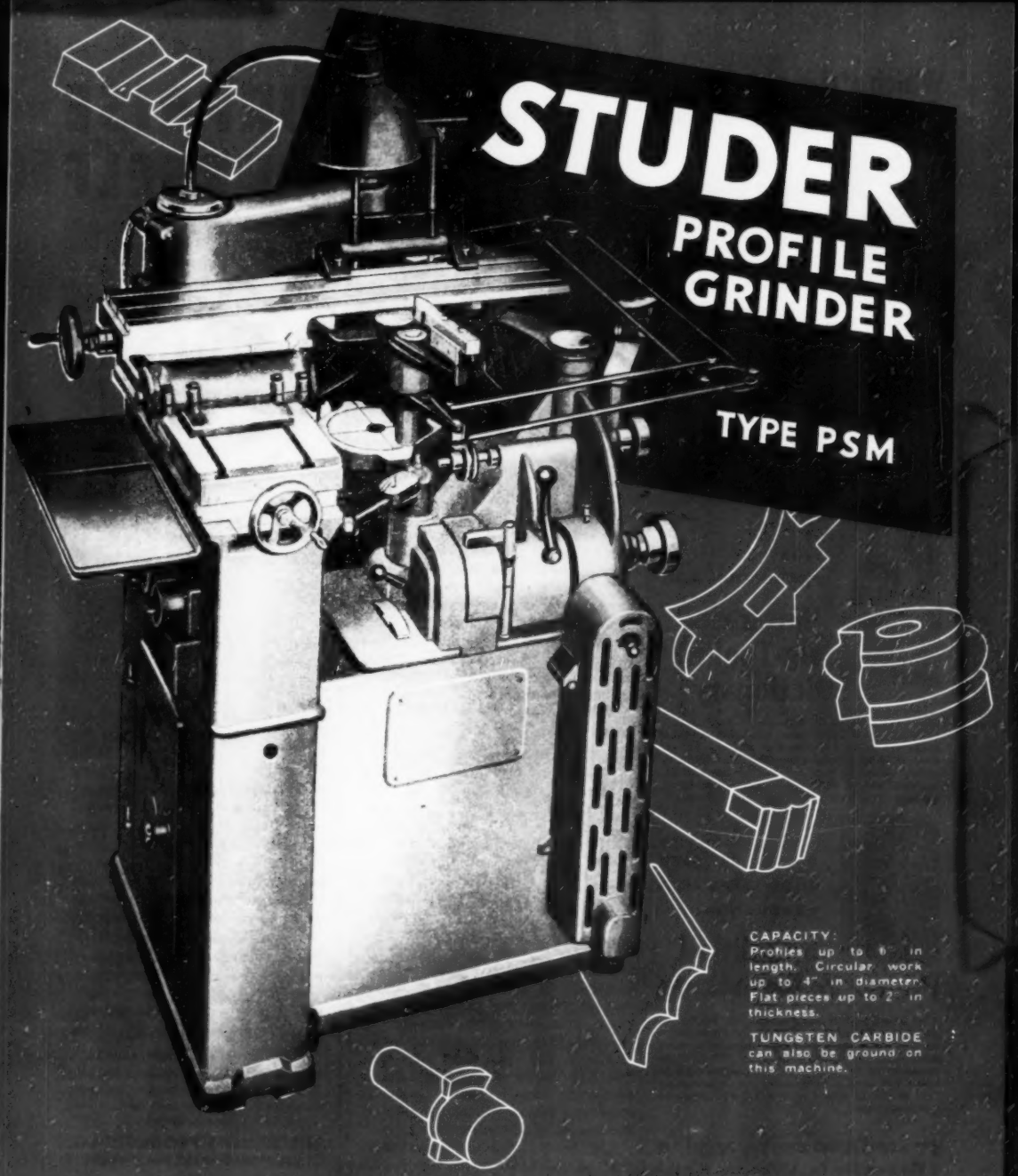
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Originally planned for special classes for war production workers, the new edition is suited to the needs of college curricula. Principles are illustrated by specific illustrations, and case problems from industry are given so the student may apply principles to work out solutions.

•

COMPANY-WIDE UNDERSTANDING OF INDUSTRIAL RELATIONS POLICIES —*Prepared and published by Industrial Relations Section, Department of Economics and Social Institutions, Princeton University, Princeton, N. J. 80 pages. Price $2.*

This report deals with the subject of keeping management personnel and employees informed on company policy. Based upon field investigations and information received from 84 concerns, the analysis includes various methods of explaining policy to each group, the influence of unions on company communications, outstanding difficulties in gaining wide understanding of policies and successful methods, and means of evaluating the effectiveness of communication media and content.

•

TRAINING EMPLOYEES AND MANAGERS —*By Earl G. Plantry, executive counselor, Johnson & Johnson; William S. McCord, director of industrial relations, Personal Products Corp.; and Carlos A. Efferson, staff training director, Chicopee Mfg. Corp. Published by The Ronald Press Company, 15 E. 26th St., New York 10, N. Y. 278 pages. Price $5.*

Explaining the actual "know-how" of setting up and operating successful programs, the authors present basic principles and concepts of training that are applicable to all business and industrial concerns. The importance of such programs in promoting managements goals of improved teamwork, and higher efficiency is also demonstrated.

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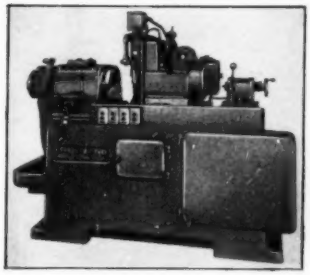

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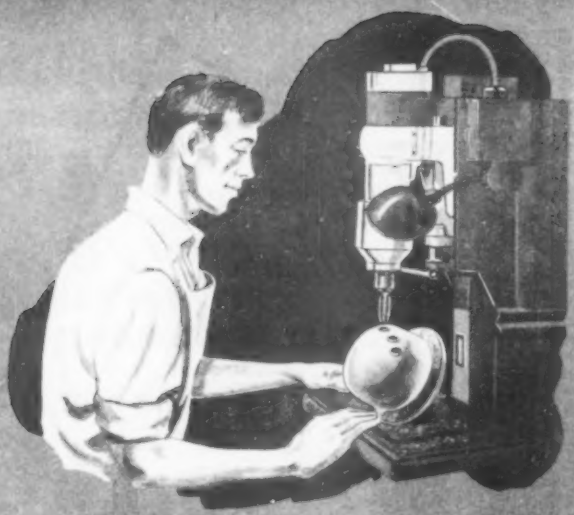

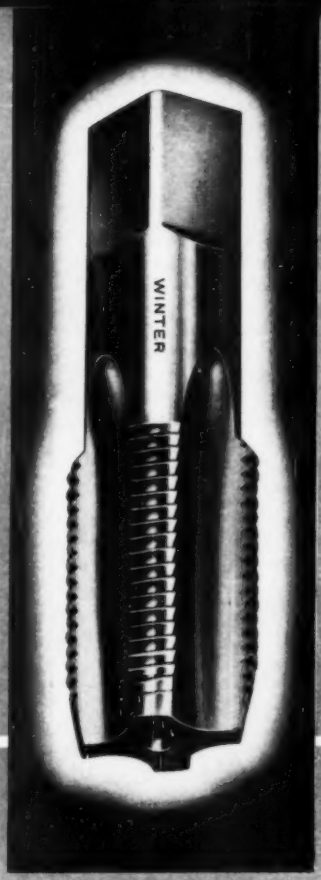


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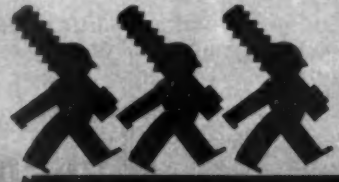


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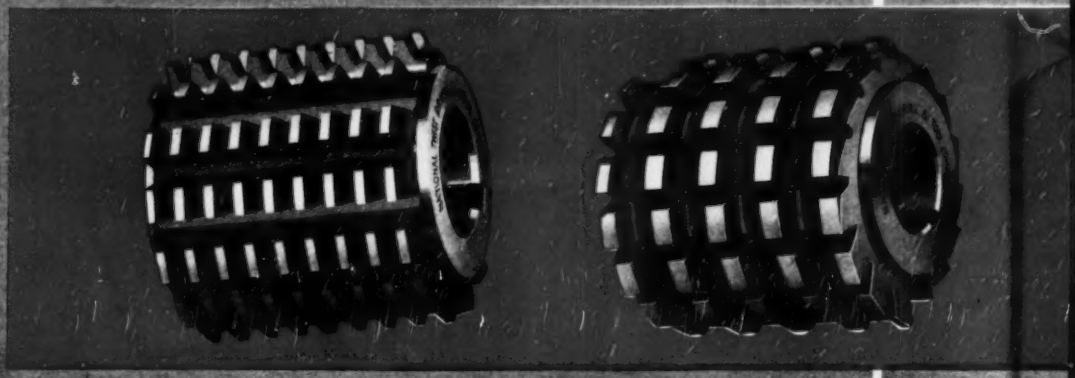

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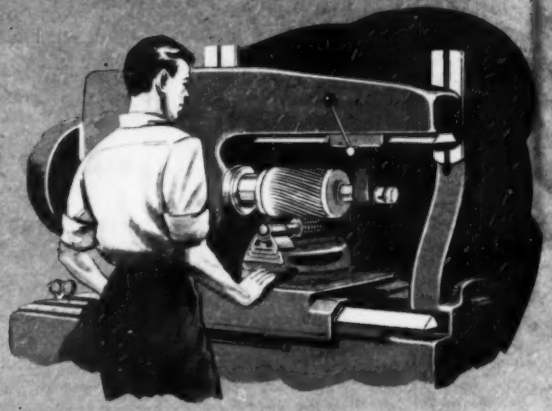

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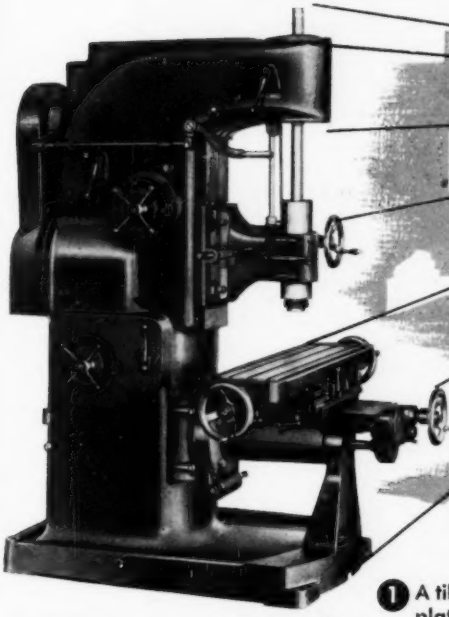

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3. Sixteen table and spindle feed changes plus four vertical spindle feeds allow the use of a wide range of cutting tools.
4. Correctly located full vision controls for direction, speeds and feeds provide the most in convenient, simple operation.
5. Heavy, strong, one-piece column casting, wide accurate bearings and precision gearing insures the rigidity which means absolute accuracy and long service life.

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**MACHINERY COMPANY**

KNIGHT VERSATILE ACCURATE RIGID

**3920 WEST PINE BLVD.**
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ATTACH TO COMPANY LETTERHEAD

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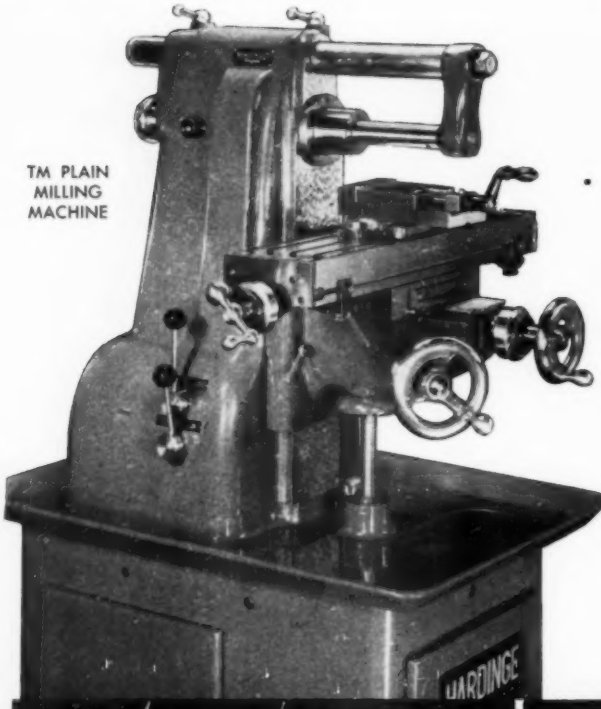
*Send catalog on Knight No. 40 and other milling machines.*

Name _____

Title _____

*MORE GOODS for MORE PEOPLE at LOWER COST*




TM PLAIN MILLING MACHINE

HARDINGE
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# Matched for Precision Work

These Hardinge high speed precision machines, matched for interchangeable attachments, will step up precision production in your tool room, laboratory, and development departments. For example, all spindles take standard 5C HARDINGE 1" capacity collets, including the spiral or plain index centers for the milling machines.

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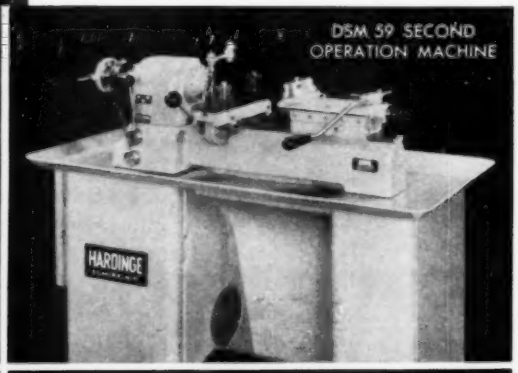


DSM 59 SECOND OPERATION MACHINE

WE 59 PRECISION LATHE

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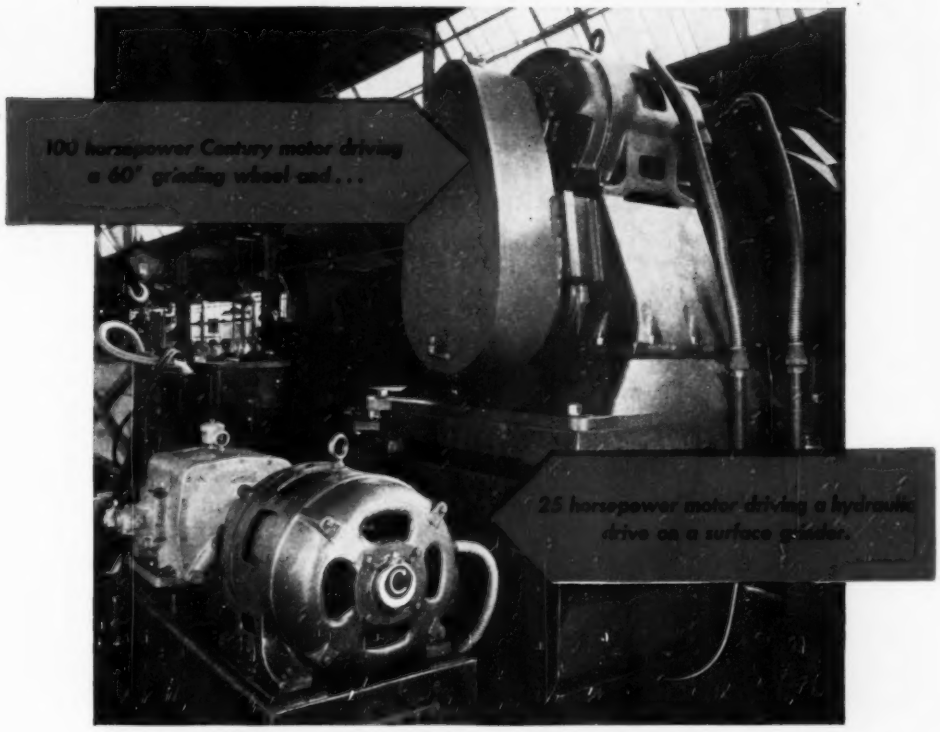

100 horsepower Century motor driving a 60" grinding wheel and...
25 horsepower motor driving a hydraulic drive on a surface grinder.

# 100 H. P. Century MOTOR—Driving a 60" Grinding Wheel Provides a Smooth Production Combination

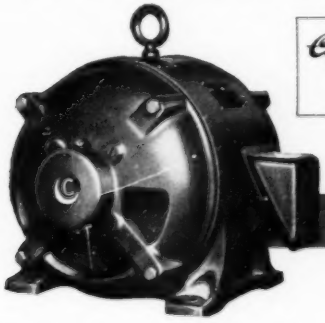
This 100 H.P. Century Motor operating a huge 60" surface grinder and the 25 H.P. Century motor operating the feeder mechanism, is one of the hundreds of thousands of Century drives used in the precision production industries.

The unusual freedom from vibration designed and built into Century motors, contributes to the precision grinding at the business end of the grinder that was intended by the manufacturer of this fine tool.

The rugged mechanical design of Century motors are suitable not only to precision applications like this but also for the heavy shock loads required in some industrial operations.

From Century's wide range of types and kinds of motors, in sizes from 1/6 to 400 horsepower, you can select the correct motor to meet the exact requirements of your machines. The properly selected Century motor on your machine tools, conveyors, processing machinery, etc., helps to increase productivity, keep maintenance costs low and reduce plant shutdowns caused by improperly applied motors.

Specify Century motors for all of your electric power requirements.



Century C MOTORS

Popular types and ratings are generally available from factory and branch office stocks

CENTURY ELECTRIC COMPANY

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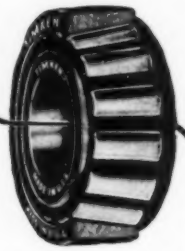
# TIMKEN *Zero precision bearings give* SHELDON *LATHES GREATER ACCURACY*



Because the spindle of the SHELDON TS56 is mounted on Timken Zero Precision Bearings extreme accuracy, higher machining speeds and lower production costs are insured.

Timken Zero Precision Bearings are by far the most accurate tapered roller bearing that can be made in regular commercial production. Run-out or eccentricity is restricted to less than .00015 of an inch. Cups and cones of Timken Zero Precision Bearings are matched and shipped as a complete unit.

Due to the line contact between the rolls and races, the spindle is firmly supported—no chance of deflection. Because of the tapered construction and provision for take-up in assembly, there is no possibility of end-movement. Zero Precision Bearings are Timken's very finest, the ultimate result of Timken's 49 years of research and development.

## SHELDON TS56

11¼" Swing
1" Collet Capacity
56" Bed
Zero Precision Bearings

**SHELDON MACHINE CO. Inc.**
*Manufacturers of Sheldon Precision Lathes • Milling Machines • Shapers*
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# HEADS

Lukens presses and spinning machines produce heads 4 inches to over 20 feet in diameter, or as thick as 6 inches . . . in every standard style and in special shapes to meet your needs . . . ferrous, nonferrous and clad steels. Catalog No. 1 describes 3,868 standard heads. For a copy and for prices, write Lukens Steel Company, 478 Lukens Building, Coatesville, Pennsylvania.

"Head Work", a 16mm motion picture in sound and color, on spinning and pressing of Lukens Heads is available without charge. Running time: 27 minutes. Write for a booking date.

HEADS ★ FOUR INCHES TO OVER [illegible] DIAMETER

• SPEED SCRAP TO THE MILLS TO MAKE MORE STEEL • •

HENDEY
No. 2
GENERAL
PURPOSE
LATHE

# Let's talk 'PRICE'

A good lathe costs money. The new Hendey No. 2 General Purpose Lathe is not an exception, but is an exceptional value. This lathe is an entirely new concept. It replaces the famous Hendey Cone Head Lathe, but retains all the facility—with a single lever belt shifter. It has eight speeds, but no expensive geared head. A unique feature eliminates belt pull on the spindle. There are 48 thread and feed changes, and graduations permit spindle indexing for cutting multiple threads. The Bed Ways, both Carriage and Tailstock, are hardened and precision ground. Here's a lot of lathe for the money—the price will please. Write today for details and catalog.

## PRINCIPAL DIMENSIONS

| | |
|---|---|
| Rated size | 14" |
| Swing over ways | 16 7/16" |
| Swing over cross slide | 10 1/4" |
| Spindle bearings—Preloaded super-precision roller bearings | |
| Spindle nose | L-1 taper nose |
| Hole through spindle | 1 1/2" |
| Range of spindle speeds | 30 to 1142 R.P.M. |
| Carriage bearings on ways | 21 1/2" |
| Width and length of cross slide | 7" |
| Compound rest travel | 4" |
| No. of thread and feed changes | 48 |
| Range of thread cutting | 1 1/2 to 92 |

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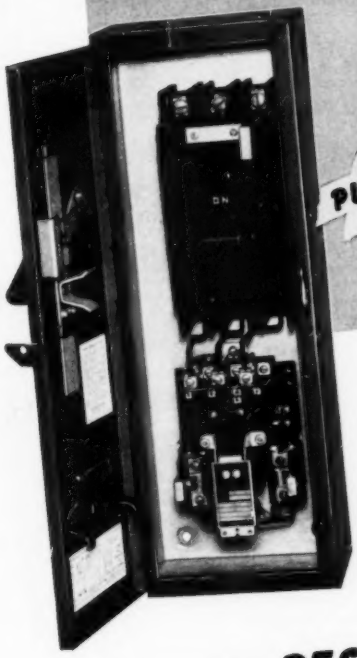
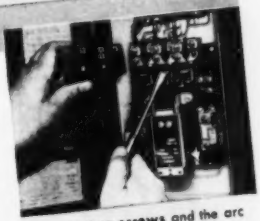
# GET COMBINATION STARTER ADVANTAGES PLUS ACCESSIBILITY

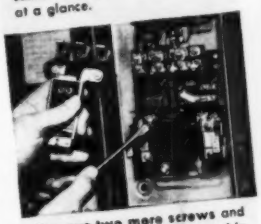


**COMBINATION STARTERS** are increasing in popularity because they are safe, easy to install, take less space and have good appearance.

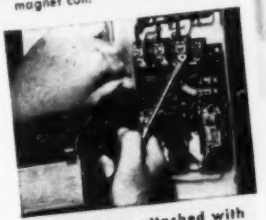
In addition to these advantages, Square D Combination Starters, with either front-operated switches or Thermal-Magnetic (Coilless) circuit breakers, feature magnetic starters that are accessible.



**Loosen two screws** and the arc chamber cover comes off. Every contact surface can be inspected at a glance.



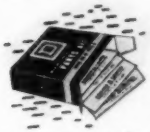
**Remove two more screws** and entire armature and movable contact assembly can be lifted off. Disconnect two wires from screw-type terminals and slip off magnet coil.



**Contacts are attached with separate screws**—can be removed and replaced without disturbing any wiring. Screw-driver is only tool needed.

## Even the *BEST* Motor Starters Need Inspection and Maintenance

ALL starters require periodic contact replacement under conditions of heavy load or frequent operation. Some may require magnet coil exchange to match voltage and frequency of power supply. That's why Square D has always stressed accessibility—simplifying installation, inspection and normal maintenance.



### *New "Off-the-Shelf" Parts Kits make normal maintenance easier than ever!*

Now, replacement parts for Square D starters are packaged in easy-to-stock kits. Each kit contains parts necessary to replace all load contacts on two or three-pole starters. Parts are individually packaged in clearly labeled envelopes. Illustrated service bulletin is enclosed for quick parts identification and complete installation instructions.

*Write for Combination Starter Bulletin 8538 and Parts Kit Bulletin 9998. Square D Company, 4041 N. Richards St., Milwaukee 12, Wisconsin.*

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**Hyatt engineers are at your service, glad to assist you in solving your bearing problems whether you are designing a new machine or piece of equipment or modernizing an existing design.**

**Hyatt Roller Bearings are used by thousands of leaders in the automotive—industrial—agricultural—petroleum—construction and transportation fields. Costs you nothing to invite a Hyatt man to confer with you. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.**

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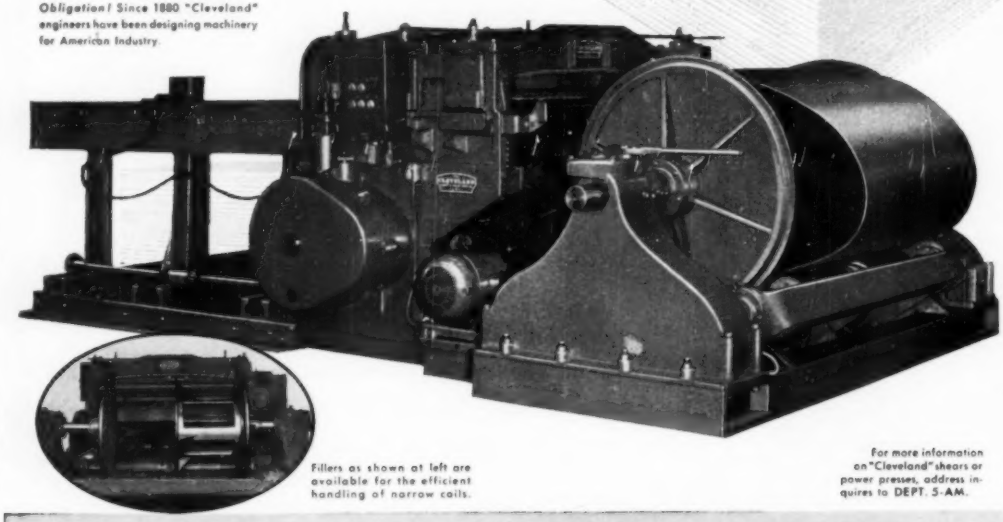
## From COILS... to SHEETS... to STACKS!

**This "Cleveland" engineered shear is made in various capacities to meet all high speed production requirements. This model has a speed up to 60 strokes per minute with a feed up to 200 feet per minute. Each is variable in proportion. Stock may be 24" to 78" wide. Operation is automatic, semi-automatic or hand controlled. All rollers are covered and designed to continuously bear on outside of coil as coil decreases. The uncoiler is heavy duty of the cradle type and there are many other important features.**

If you have special production problems, consult with our engineering staff at *No Obligation!* Since 1880 "Cleveland" engineers have been designing machinery for American Industry.





Fillers as shown at left are available for the efficient handling of narrow coils.

For more information on "Cleveland" shears or power presses, address inquires to DEPT. 5-AM.

## THE NEW PATENTED "CLEVELAND" DRUM TYPE FRICTION CLUTCH & BRAKE

For greater power press efficiency and reduced production costs, designed to give full clutch and full break, as needed. ¼ the weight of the conventional disk friction clutch and brake, with ½ the number of parts. Now available for all types, sizes and makes of mechanical power presses.

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**FABRICATING TOOLS**

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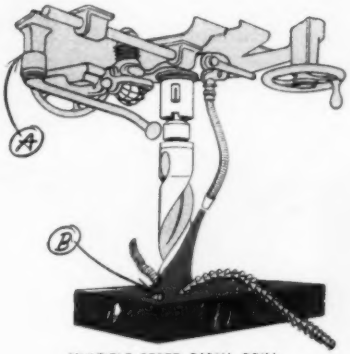
## Case 1146—Selecting the Correct Cutting Fluid




MULTIPLE SPEED RADIAL DRILL

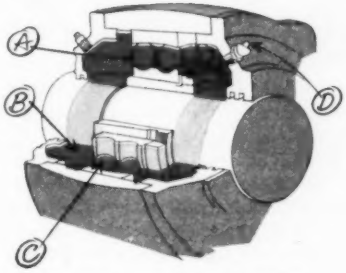
In tests on machine tools of all different types, the Calol Cutting Fluid recommended for each operation produced fine surface finish on work. This is because recommendations for Calol Cutting Fluids are made from actual working results — tests made on a special drillpress, the Drilling Torque Tester — and the results recorded by electronics. Calol Cutting Fluids come in four general classes: mineral oils, ready-mixed compounded oils, concentrates and soluble oils.

A. Made for every machining operation — from toughest broaching to simple grinding.

B. Maximum lubricating, cooling and flushing qualities assure longer tool life and better work finish.

Calol Cutting Fluids also give maximum rust protection to machine tools and work. The soluble oils in the line mix with water easily and form strong, stable emulsions.

## Case 1147—Lubricating Bearings Carrying Extreme Loads




HEAVY-DUTY INDUSTRIAL BALL BEARING

In tests by a bearing company, Calol E.P. Roller Grease carried bearing loads in excess of 20,000 pounds per square inch, more than twice the load-carrying capacity of ordinary greases. For anti-friction or plain bearings. Comes in three grades and two types: Nos. 0, 1X and 2X. The "X" type has additional compounding to impart extra stringiness, and extra adhesiveness to withstand washing action of water on bearings.

A. Extreme-pressure additives assure lubrication under extreme shock load conditions.

B. Resists extreme temperatures — has lubricated satisfactorily in bearing temperatures of more than 200° F.

C. Non-corrosive to any bearing metal . . . will not harm rubber, neoprene or plastic bearing seals.

D. Pumps easily in low temperatures . . . may be used in all grease pressure systems.

For additional information and the name of your nearest Distributor, write

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...because it's a Comfortable Eye-Protector!

## AO F-9200 Acetate Goggle

When we brought it out, we were sure there was a great future ahead for this goggle of non-flammable cellulose acetate butyrate—but its popularity has surprised even ourselves! Here are its features that workers appreciate:

1. ASSURED PROTECTION.
2. Hinges and temples out of line of sight.
3. Smarter appearance.
4. Lenses that conform to and cover eye orbit.
5. Improved fit.
6. Comfortable, lightweight, face-formed bridge.
7. Nosepads which distribute goggle weight *evenly*.

This goggle does a prime protection job on operations in chemical and electrical plants where the tiniest spark might cause fire or explosion. Because of its acetate construction it is especially recommended for these and similar jobs where metal goggles might not be recommended. Available with ventilated side shields for added safety against lateral-striking objects. Lenses are 6-Curve Super Armorplate. When protection from glare, ultraviolet or infra-red radiations is a "must", specify Calobar lenses. For a handy source of supply, see the AO representative. There is always one near you.

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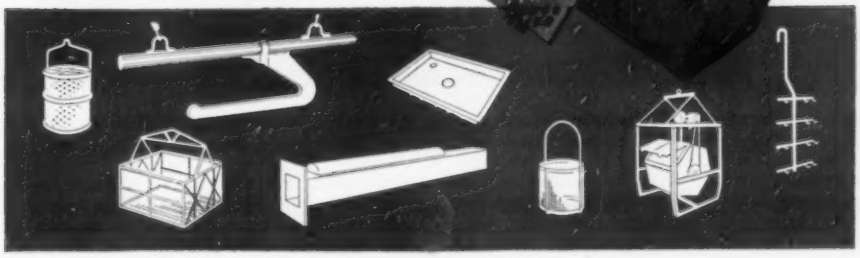
## FABRICATED ALLOYS

The chief target today for cost-cutting in metal working plants is in handling operations. Speed of movement, larger batches for each finishing operation, decreased weight of equipment, and refinement of design are of paramount importance. Rolock engineers add to these requirements a technique in the fabricating of modern alloys that is extending the service life of handling equipment to a marked degree.

We feature herewith a rugged motor-driven Rotating Pickling Barrel for better pickling of 500 to 1000 lb. loads. It was job engineered to set upon the edges of various tanks, the Monel barrel part extending down into the pickling solutions.



Hundreds of leading plants are finding competitive advantages in Rolock baskets, trays, crates, racks, fixtures, retorts, and a variety of distinctive equipment, fabricated to suit the specific job. We have solved some tough problems . . . are looking for more. You will find us easy to work with . . . experienced and helpful in reducing your handling costs. Write for interesting catalog today.

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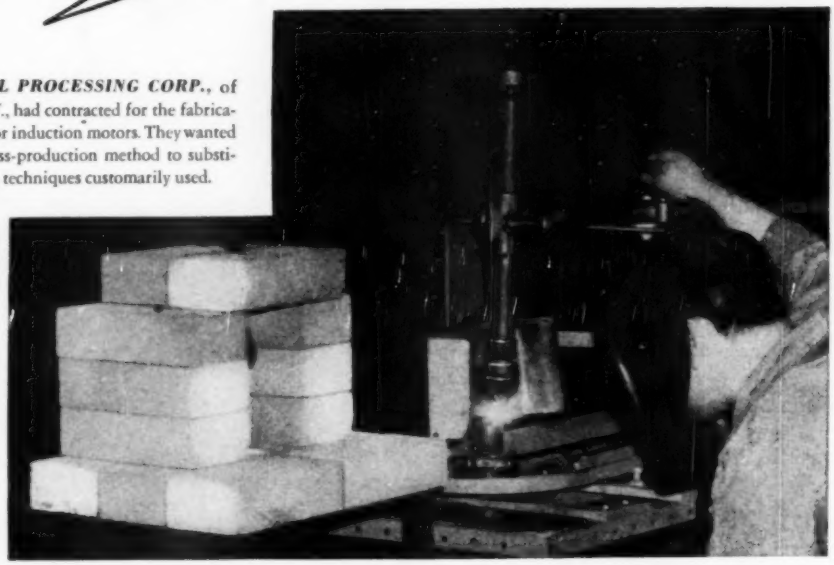
**JOB-ENGINEERED for better work**
**Easier Operation, Lower Cost**

# Heliwelding permits mechanized rotor mass production

***SALKOVER METAL PROCESSING CORP.***, of Long Island City, N. Y., had contracted for the fabrication of copper rotors for induction motors. They wanted a fast, mechanized mass-production method to substitute for the piece-work techniques customarily used.



***H. A. Huff, Jr.***, Airco Technical Sales Representative, suggested Heliwelding with an Airco machine holder. He devised a balanced work-cycle which permitted a simultaneous preheating and welding operation. When, for example, one rotor is being preheated, another is welded. A spindle holds and turns the latter under a $\frac{1}{8}$" tungsten electrode in an Airco water-cooled machine Heliweld holder, mounted flexibly on the Radiagraph arm. Straight polarity 150 amperes D.C. is used, with helium as the shielding gas.

The operation is rapid and production is extremely high. Not only is the method economical, but most important, it permits complete control of operating variables — results in finer welds, with a minimum of rejects.

• • • •

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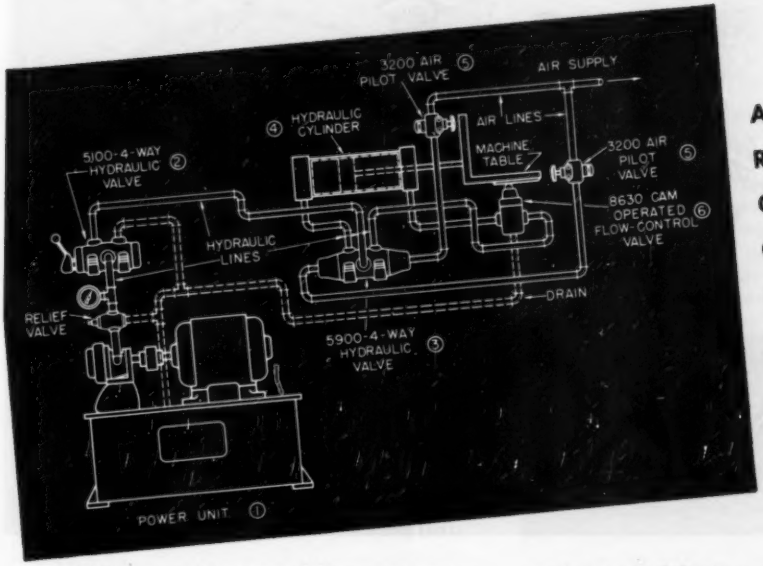


**AUTOMATIC RECIPROCATING CIRCUIT FOR CONTROLLED FEED OF MACHINE TABLE**

Shifting model 5100 (2) control valve allows oil from pump unit (1) to pass through model 5900 (3) pilot operated control valve to the blind end of cylinder (4), causing piston to move forward. As cam of model 8630 (6) flow control valve is depressed, the required rate of speed of forward stroke is obtained. When model 3200 (5) pilot valve is contacted, pilot pressure shifts model 5900 (3) pilot valve, and cylinder travel reverses. To stop table, shift model 5100 (2) control valve to original position and oil is by-passed to tank at zero pressure. Use cushioned cylinders when piston velocities and inertia of connected loads are high.

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**1 EXPERIENCED DISTRIBUTORS**
qualified to solve your circuit problems. Located in all principal cities.

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air and hydraulic valves and cylinders; hydraulic pumps, pump units and hydraulic motors.

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Cutting fluids that once helped your machines set production records may now prevent your shop from meeting demands for increased production and lower costs. Modern machine tools can operate at feeds and speeds formerly impossible... but they require a cutting fluid that keeps work, chips and tools cool to permit maximum tool life, accurately finished work.

That's why more and more production men specify Lusol, a true solution that withdraws heat rapidly . . . permits higher speeds, closer tolerances, fewer rejects, less down time

Send for test sample today.

**F. E. ANDERSON OIL COMPANY**
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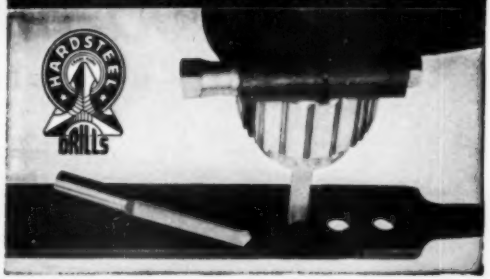
## Drill Hardened Steels *without Annealing* with "HARDSTEEL"




Don't let anyone tell you that hardened steels must be annealed before drilling, countersinking, counterboring or reaming.

With "HARDSTEEL" drills you can produce accurate, smooth holes in steels hardened by any process — oil-hardened, water hardened, cyanided, nitrided, and they work equally well on work-hardening steels, and high carbon-high chrome steels of any degree of hardness.

"HARDSTEEL" drills used with standard drill presses cut costs in production shops because parts drilled after hardening always match at assembly. In service shops they save time and material and permit engineering changes calling for additional drilling to be made after parts are full hardened.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are now functioning in thousands of plants in parts recovery operations.

***You Harden It — We'll Drill It — with "HARDSTEEL"***

*"HARDSTEEL" Tool bits make faster, deeper cuts on steels and non-ferrous alloys.*

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# AIR HOISTS

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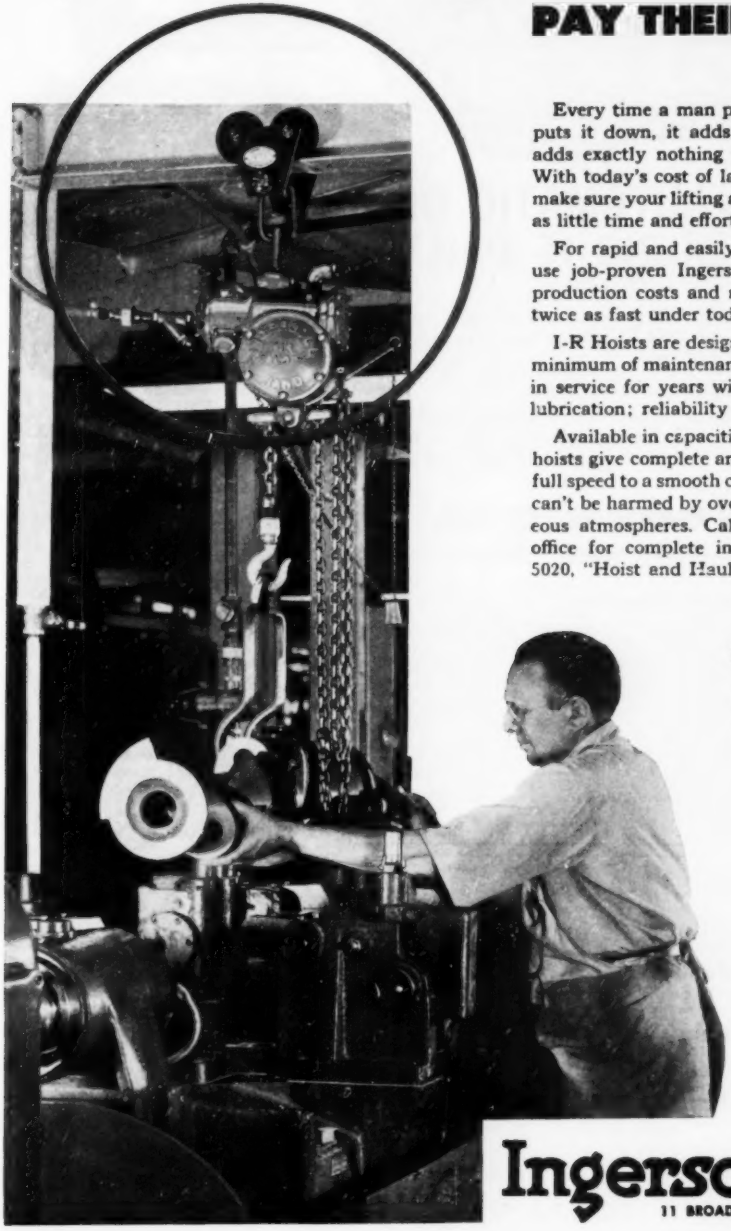

Every time a man picks up material, moves it, and puts it down, it adds to your production costs, yet adds exactly nothing to the value of your product. With today's cost of labor, it's only common sense to make sure your lifting and moving operations consume as little time and effort as possible.

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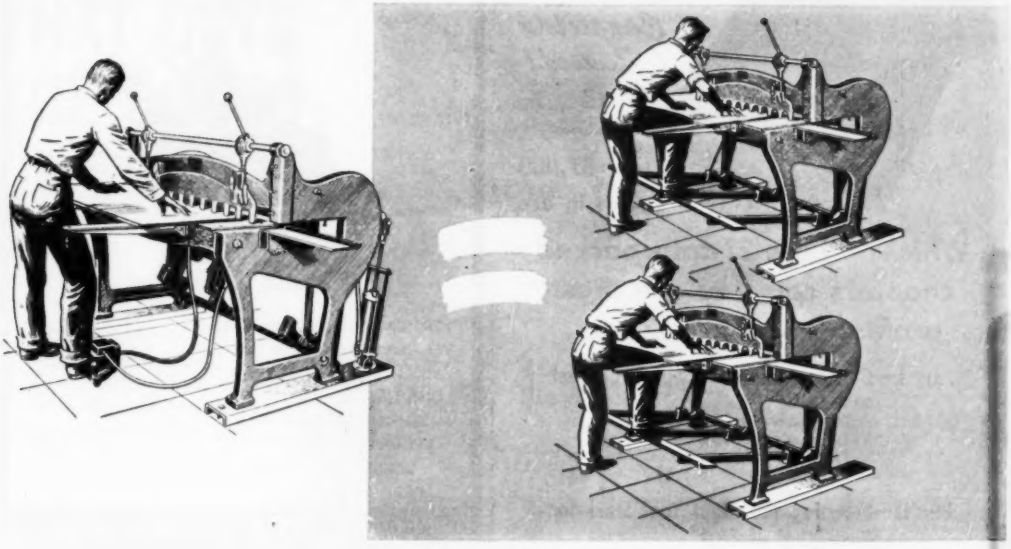

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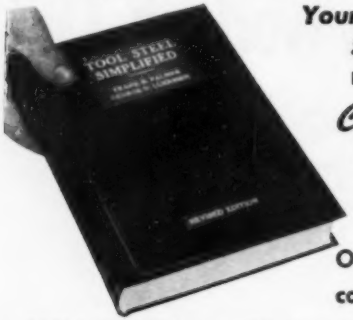


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11. Hardness and Toughness Testing
12. Properties and Heat Treatment of Twelve Matched Tool Steels
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14. Relation of Design to Heat Treatment
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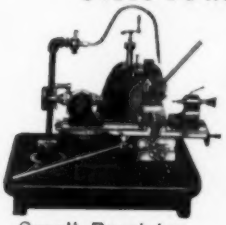

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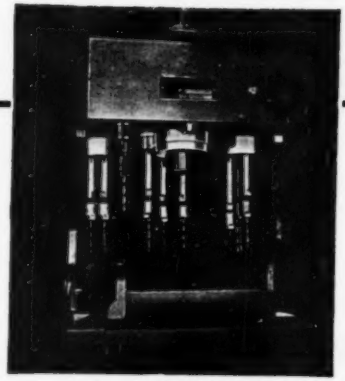

**Shown is a ten spindle multiple drilling head, drilling ten varied size holes on different elevations. The head has grooved thrust ball bearings at all thrust points and hardened bronze radial bearings. Heat treated spindles and gears of one piece turned from solid bar stock. It is geared approx. 2:1. All encased in a sand cast aluminum case and cover, with alemite pressure lubrication.**

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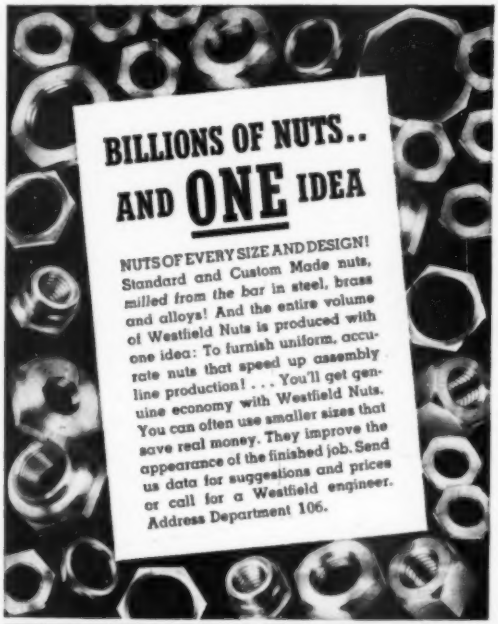

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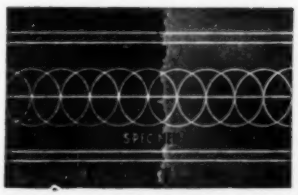

Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

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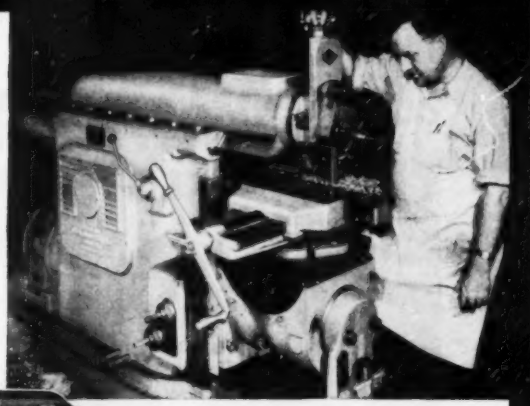
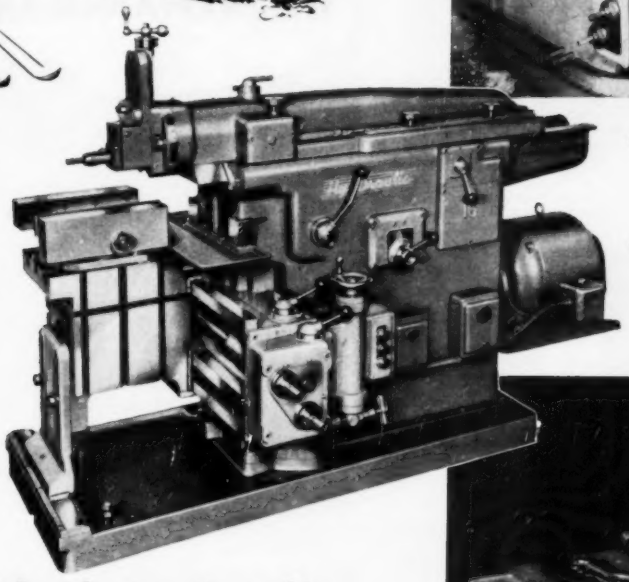
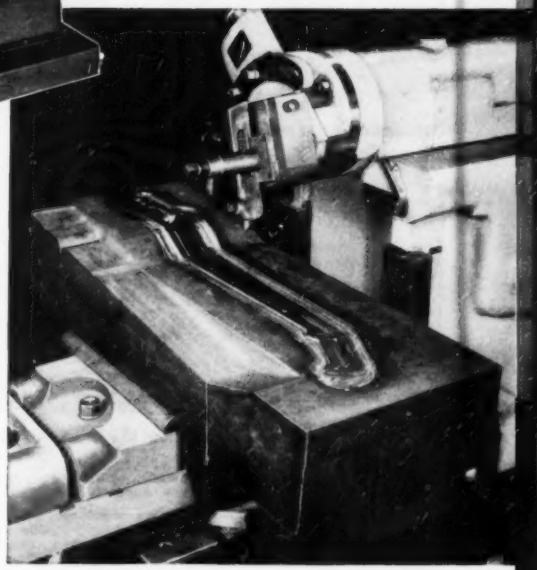




- Shaping a milling machine fixture from cold rolled steel plate on a 24" Rockford Hy-Draulic Shaper at Aeronca Aircraft Corporation. Smooth final finish.
- Shaping a hand brake lever die from #3 Die Block steel on a 24" Rockford Hy-Draulic Shaper at The Cleveland Hardware and Forging Co. Dimensions held to ± .001". Very smooth final finish.



## Rockford Hy-Draulic
# SHAPERS

No first rate skier shrinks from championship competition. Similarly, in the machine tool field, Rockford welcomes a full point-for-point comparison of its Hy-Draulic Shapers with any other shaper made today.

We invite you to be judge, referee and umpire. Score Rockford Hy-Draulic Shapers against any other machine you know . . . on such performance points as versatility, ease and speed of set-up, close tolerance machining, smoothness of work finish and last, but not least—SPEED.

You will be considerably surprised by the point-lead piled up by Rockford. The reason lies in the basic advantages of Rockford Hy-Draulic design. You owe it to yourself to find out exactly how and why it can reduce the cost of your shaper operations. Rockford Hy-Draulic Shapers are built in 12" to 28" ram type sizes and as a 36" Openside Shaper. Write for Shaper Bulletin 442.

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**Special switches** were needed to complete an electrical instrument contract. Late delivery of finished items would kill chances of future orders. Switches were 1100 miles away, but Air Express delivered the 15-lb. package 8 hours after pick-up. Cost, only $5.07. Air Express now used regularly. Keeps down inventory, improves customer service.

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**World's finest** Scheduled Airline fleet carries Air Express. 24-hour service—speeds up to 5 miles a minute. Direct to over 1000 airport cities; air-rail for 22,000 off-airline offices.

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17-lb carton of hearing aids goes 900 miles for $4.70.
12 lbs. of table delicacies goes 600 miles for $2.53.
(Same day delivery in both cases if you *ship early.*)

**Only Air Express gives you all these advantages:** Special pick-up and delivery *at no extra cost. You get a receipt for every shipment* and delivery is proved by signature of consignee. One-carrier responsibility. Assured protection, too—valuation coverage up to $50 without extra charge. Practically no limitation on size or weight. For fast shipping action, phone Air Express Division, Railway Express Agency. And specify "Air Express delivery" on orders.

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GETS THERE FIRST

Rates include pick-up and delivery door to door in all principal towns and cities

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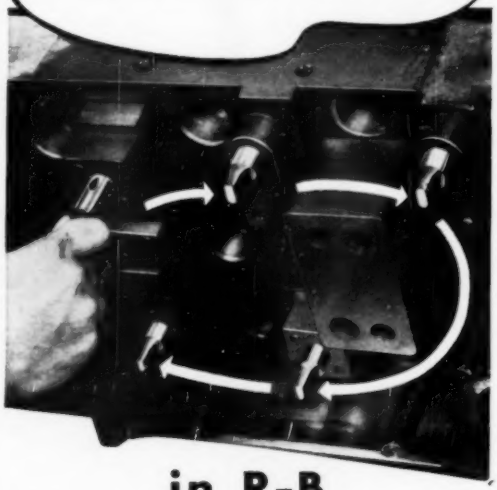

## in R-B PUNCHES and DIES

Here's part of a die which holds ten R-B oblong punches, any one of which will interchange with the other nine . . . or with any other R-B punch of a like size . . . mating perfectly with the corresponding die. Such interchangeability . . . which cuts inventories to a minimum and reduces die making costs . . . results from the complete uniformity found in R-B punches and dies. They are made from selected steels with hardness controlled, and finished to the necessary close tolerances. Correct alignment is assured both vertically and radially.

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# Locating to close tolerances—2 case studies

**Automatic drilling and tapping machines cut costs by locating operations accurately and increasing output per man-hour**

Dear Sir:

Automatic drilling and tapping machines locate operations to close tolerances in production because:

All tools operate on the part in the same chucking.

Bushings guide drills and reamers. Bushing plates pilot to the fixtures.

Spindles are located to exact indicator readings.

Automatic unvarying cycles make all parts uniform.

### Cost is low when output is high

Notice how low the costs are: 15c for the cam with 56 operations; 2-3/10c for the brake cylinder with 11 operations. These costs include both man and machine on this basis: (1) the current average national wage rate, (2) 80% efficiency, and (3) the machine paid for after only 6000 hours, a fraction of its profitable life. No power or overhead.

Cost is low when a Kingsbury does many operations each hour. Reduce output and naturally unit cost goes up. Sometimes this makes a Kingsbury uneconomical. But if accurate location is a problem, it may still be the best solution. That reminds us of a story.

### An expert is surprised

A man who knew our machines saw us one day during the war. "I always thought Kingsburys were high production machines."

"You are 98% right," we said.

"Well then, I just saw some of that other 2%," he said. "An aircraft plant I just visited has a line of 11 Kingsburys. Only one machine was running at a time. Fellow would put one lot of cylinder heads through a machine, shut it off, take the truck load to the next machine and do the same thing there."

"Locating to close tol—," we began.

"Oh, sure, sure, sure," he said. "I realized that right off. After I looked at the job I would hate to do it any other way. Fellows there are tickled to death with their Kingsburys. Said they had several lines of them."

"Indeed they have," we said. "Just ask us to figure a compound angle. We have done so many of these machines we are old hands at compound angles. But at first we had to have 10 engineers figure them. When 2 of them agreed we started with their figures and went on from there."

We admit this application is unusual. We even admit (reluctantly) that there are other ways to drill and tap to close tolerances in production. But we do feel that our proposals for this work merit your serious consideration.

### For many high production jobs

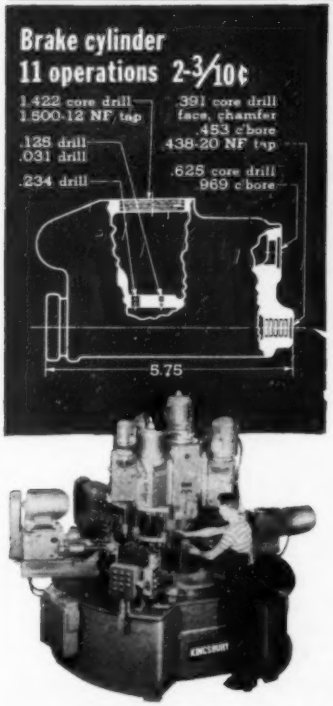
Locating to close tolerances is an important advantage with a Kingsbury. But low cost on high production work is still the main reason for using them. We can make efficient setups for many different jobs — simple or complex, with small or medium operations. (Note the brake cylinder with .031 drill and 1.422 core drill in the same chucking.) Here is why: We can choose from a complete line of standard drilling, tapping and indexing units and attachments. We have designed, built and tooled over 3,500 machines. It is our sole business.

Can we make you a proposal for a tooled machine? Just send a print to our Mr. L. A. Carll. Tell him the operations and hourly output you need. It is worth a few minutes to get the facts.

Sincerely,

Kingsbury Machine Tool Corp.
60 Laurel St., Keene, N.H.

P.S. Free bulletins showing 40 setups are yours for the asking. Please use your company letterhead.

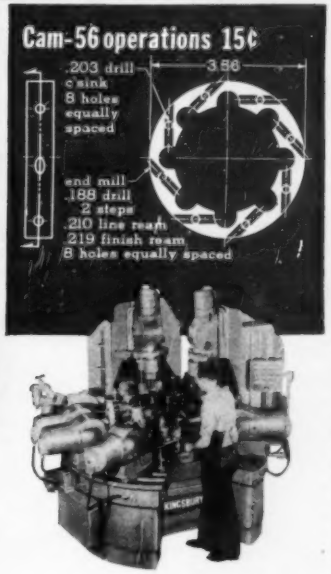



**360 PARTS AN HOUR GROSS**

To locate every operation exactly, bushings guide every tool except the taps. A ball bearing bushing guides the 1.422 core drill. Other bushings are plain. All bushing plates plug into the fixture or the part itself.

• Ten units operate in turn on each part. The base supports 4 horizontal units, the central column 6 vertical units. Every tool is in easy reach because the working area is not caged in.

• Note the range of operations. A 1.422 core drill (5 hp) and a .031 drill (½ hp) operate in the same chucking.




**49 PARTS AN HOUR GROSS**

This is one of 10 Kingsburys that an automobile plant uses on related high production jobs to locate accurately peripheral holes inclined at a 40° angle to the surface.

• Bushings in piloted plates guide 3 of the 5 tools for each peripheral hole. The sequence: end mill (guided), drill first step (guided), drill through, line ream (guided) and finish ream. Drilling in 2 steps maintains required output by keeping the time cycle down.

• Each part passes around the machine 4 times. After the 1st, 2nd and 3rd passes, the operator rotates each fixture 90°. Each time around, 2 vertical units with 2-spindle auxiliary heads operate on two .203 holes, and 10 horizontal units operate on 2 adjacent peripheral holes. Five horizontal units are 22½° left of the radial line, 5 are 22½° right.

85

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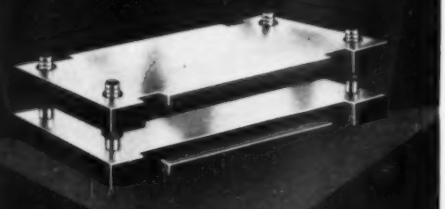
**AUTOMATIC DRILLING AND TAPPING MACHINES**
*for Low-Cost High Production*

*Finely Made Special Die Sets*



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8" x 24" $109.30
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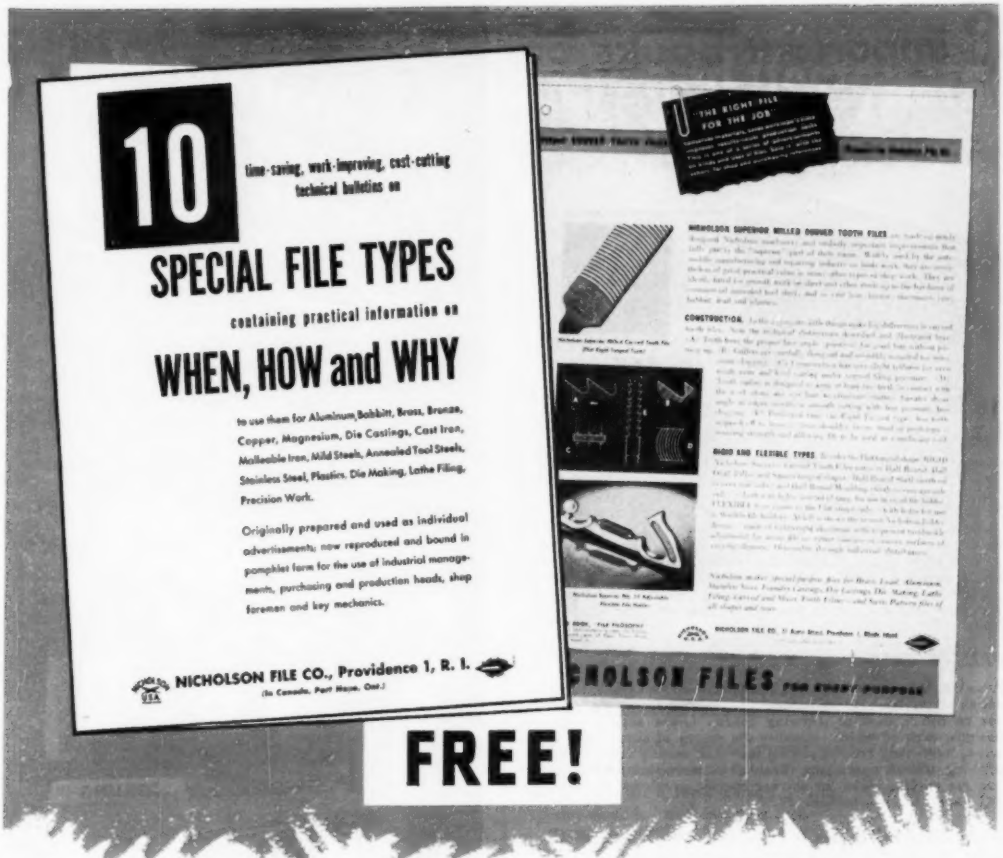
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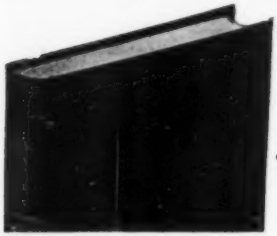

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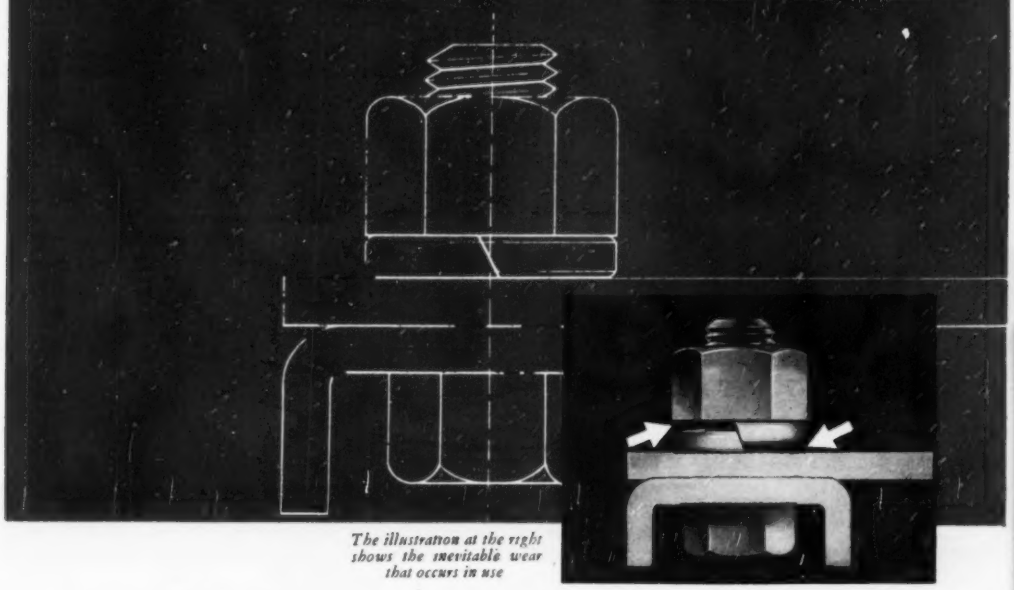

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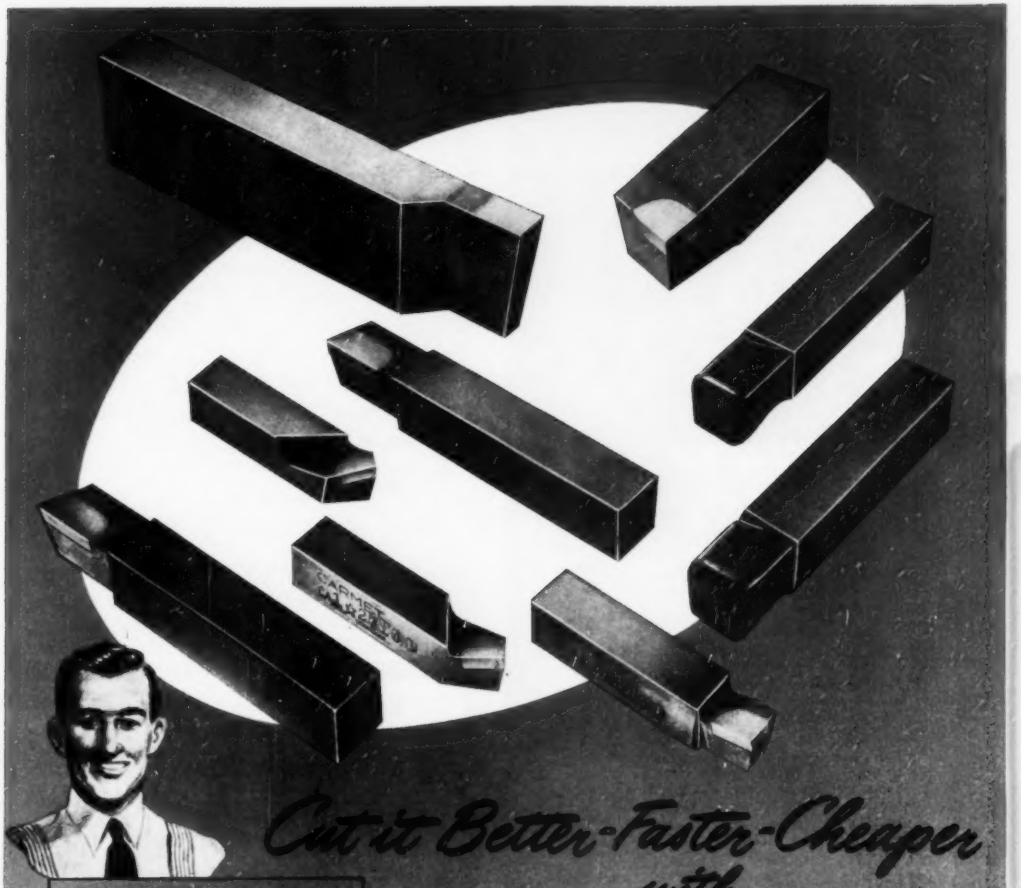

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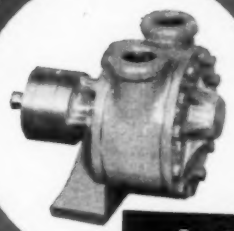

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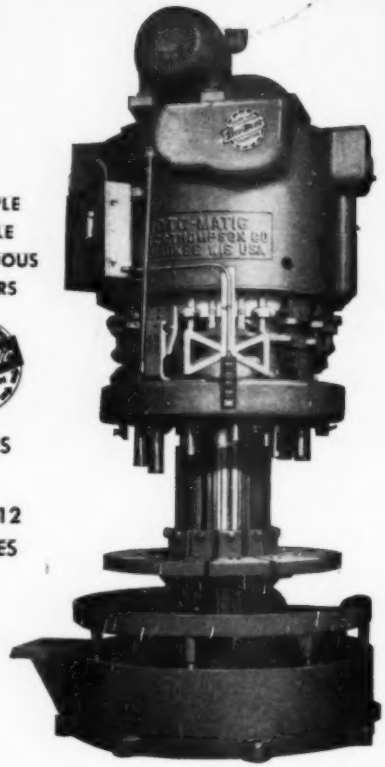

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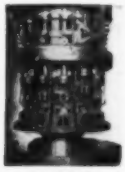

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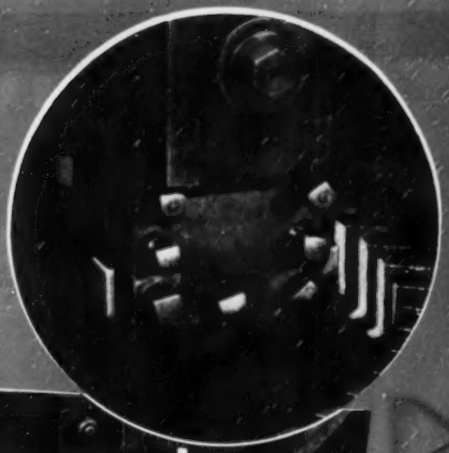

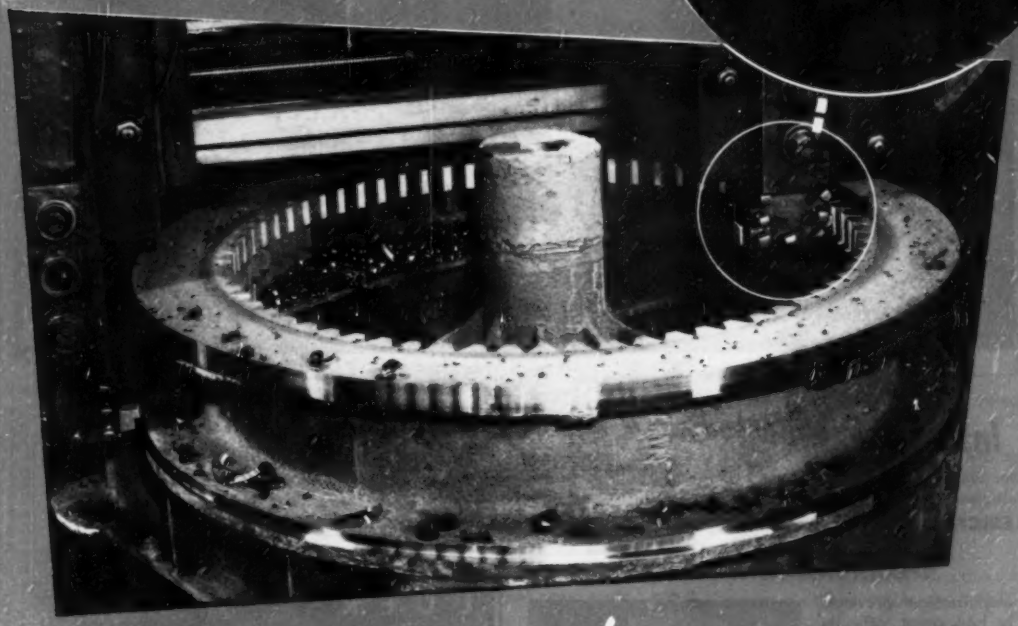

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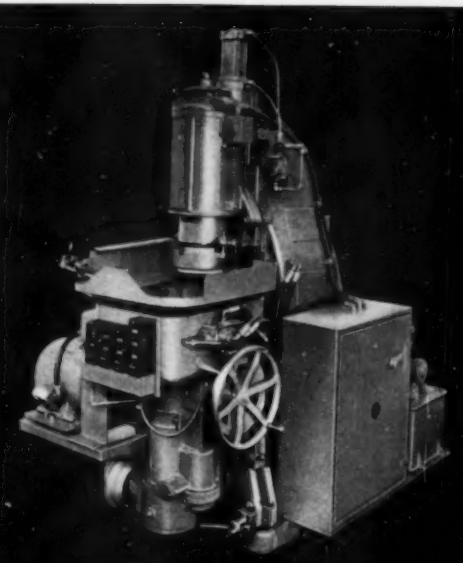

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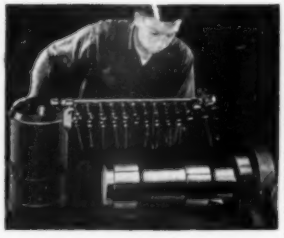

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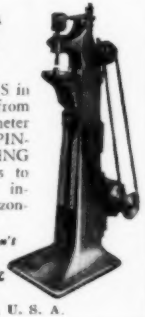

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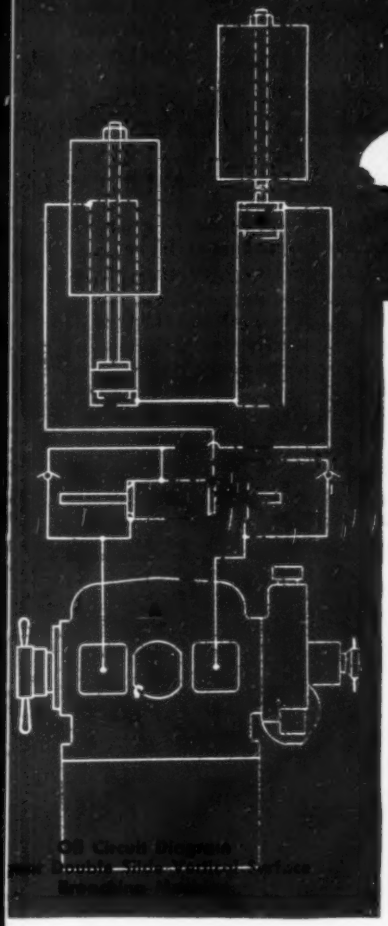

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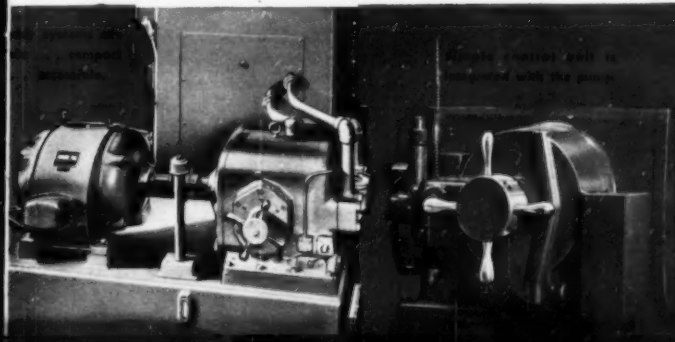
Oilgear Broaching Machines always have been and are today the most highly productive line of broaching machines. There is an Oilgear Machine for every broaching need and if you are not familiar with the entire line you are invited to send for bulletins. THE OILGEAR COMPANY, 1312 W. Bruce St., Milwaukee 4, Wisconsin.



Oilgear
Fluid Power
BROACHING MACHINES AND BROACHING PRESSES

# When you need the right gear *in a hurry*

It's one thing to get a gear cut exactly to your specifications . . . and another to get it *on time*. To be sure of satisfaction *both* ways, there's only one safe thing to do: specify Grant gears. For, whether you order by 'phone, telegraph or letter, Grant will have just the gear you want on its way in a matter of hours.

Next time a gear breakdown threatens a costly production tie-up, remember Grant's "in-the-pinch" service. Send today for free catalog of "In Stock" gears.

Reduction Units?
Grant has all types.
Write for catalog.

GRANT GEAR WORKS, INC.
154 W. SECOND STREET
SO. BOSTON, MASS.

**Grant FOR GEARS**

## Geared for Economies

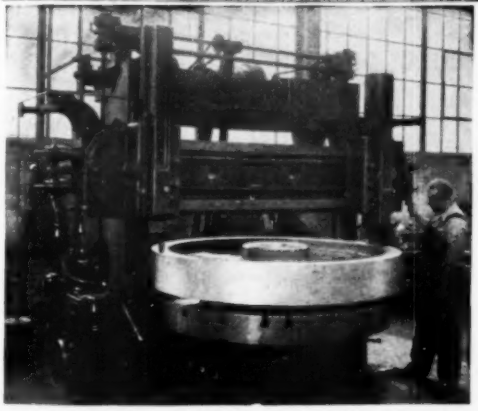
**Purchasing and Production men agree, "For right price, for easy installation and operation" — it's gears by**

# BRAUN

**Braun has complied with manufacturer's specifications, delivery and price requirements for 38 years. This extensive experience is aided by our up-to-date plant. Braun is a reliable, economical source for gears. Send your inquiries without obligation.**

BRAUN GEAR COMPANY
239 RICHMOND STREET BROOKLYN 8, N. Y.

## *A Big Mouthful..*



A big job, handling a gear blank this size and machining it accurately, but Stahl has the equipment to do it . . . and the men who know how to do the job well. From rough casting or forging to finished job, Stahl Gears get the painstaking attention that your gears deserve.

Modern equipment, capable of handling gears of any size, in any quantity . . . plus skilled workmen—the right combination for quality gears priced right and delivered on time. *Get a Stahl estimate first!*

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SPUR—SPIRAL
BEVEL—RACK
AND PINION

UP TO 60" PITCH DIA.
UP TO 10" FACE WIDTH

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Well Designed . . . Good Features
Create Production Advantages

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## ATLANTIC GEARS

precision-cut and inspected, on new, latest equipment. All sizes and types. Send samples or blueprints for quotation.

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## QUALITY GEARS CUT TO ORDER

• MEISEL produces but one *kind* of gears . . . gears constructed for specific jobs. Only through the inherent accuracy of this special designing could such dependability, performance and economy be possible. Tell us what you expect it to do, and we'll show you the one gear suited for your job.

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Established 1888

## MOTORIZED GEAR SPEED REDUCERS

A CENTRALLY BALANCED DRIVE WITH GREAT EMERGENCY STRENGTH

*Simplified assembly using standard flange motors, coupling connected with high speed pinion gear shaft, making for greater accessibility.*

SINCE 1906 . . . When the first D.O.James Motorized Gear Speed Reducer was built . . . We have improved the design and manufacture of Motorized Gear Reducers, maintaining in them the same high quality of manufacture as our other standard Gear Speed Reducers.

The many advantages of D.O.James Motorized Gear Speed Reducers and their continued proven performance for many years make them a leading choice with power transmission designers and engineers.

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MAKERS OF ALL TYPES OF GEARS AND GEAR SPEED REDUCERS
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Reg. U. S. Pat. Off.

One GUARANTEED PITTSBURGH

## ARMORED GEAR

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BEVELS
WORMS
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WILL OUTLAST FIVE UNTREATED GEARS!

You'll admit it takes plenty of confidence to guarantee gears. But tests prove the Pittsburgh ARMORED GEAR Line really have what it takes . . . enough "guts" to outlast untreated gears 5 to 1. What's more they will equal or exceed the life of any other treated gear made. And we put our *guarantee* on that!

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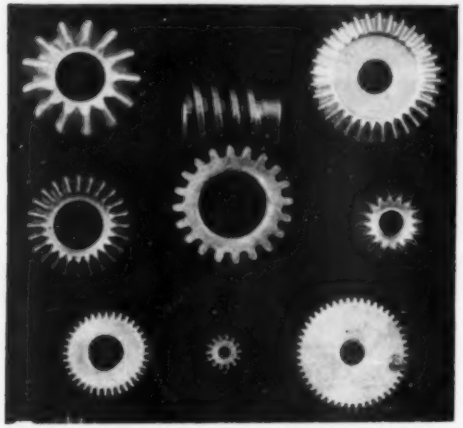
QUALITY GEARS FOR OVER 30 YEARS

## Do You Use Small Gears?



Capitol gears shown above are *actual size*. Gears like these are made for electric clocks, cameras, instruments, outboard motors, and the like. Accuracy and precision provides smooth, quiet operation and long continuous service. Whether you need small or large gears, select Capitol gears for high quality and prompt deliveries.

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TWO WHITON EXCLUSIVES ASSURE LONGER LIFE

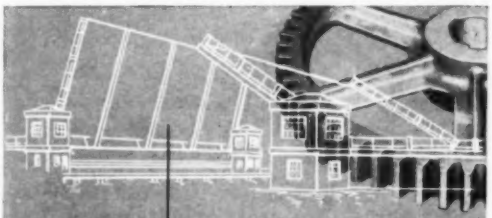
DOUBLE BUSHED

1. Chrome plated scroll threads and scroll bars give maximum wear and minimum backlash.
2. Renewable hardened bushings at either end of pinions give long wearability and stabilize pinion end play.

Rigid individual process inspection and exhaustive tests after assembly guarantee chuck users the best in work holding. If you have a work holding problem, WRITE WHITON. Ask for catalog No. C-47.

Makers of Fine Chucks • Steam Turbines • Centering Machines • Gear Cutting Machines

THE WHITON MACHINE COMPANY
NEW LONDON CONN



EARLE GEARS ARE BUILT FOR HEAVY DUTY

Earle Gears are plenty tough—can take hard usage, year after year. Take, for example, the job they are doing on the President Harry S. Truman Bridge in Missouri—or on the Oceanic Bridge in New Jersey.

For years, Earle Gears have proved their ability to give uninterrupted service with a minimum of maintenance on swing, vertical, rolling lift and bascule bridges as well as dams, gates and dredges.

The manner in which they stand up to heavy duty like this is indicative of the service they will give you. Send for our catalog. THE EARLE GEAR & MACHINE CO., 4707 Stenton Ave., Philadelphia 44, Pa. Sales Offices: 149 Broadway, New York 6; 901 Davis Ave., Pittsburgh 12, Pa; 7738 Market St., Youngstown, Ohio.

It's good business to do business with EARLE

EARLE GEARS

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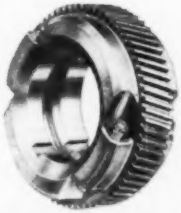
The right gear for the job . . . conserves materials, saves workmen's time, improves results . . . cuts production costs.

- ★ SPUR
- ★ BEVEL
- ★ HELICAL
- ★ SPLINE
- ★ WORM
- ★ SPECIAL

The manufacturer, design engineer and production expert make the selection of dependable gears one of their definite responsibilities.

It is common practice in hundreds of plants to specify *Cincinnati Gears, Good Gears Only*. Their precision control, accuracy and performance guarantee assured dependability.



Each Cincinnati Gear is made to fit your particular specifications . . . saves time and money and puts the right gear in the right place.

THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
Wooster Pike and Mariemont Ave. ★ Cincinnati 27, Ohio

Grip the Sides of

# ANY V-Belt...

FEEL the Sides CHANGE SHAPE

as the belt Bends –

-That SHOWS you Exactly WHY

# THE CONCAVE SIDE

(U. S. PATENT NO. 1813698)

# SAVES You MONEY

***Bend any V-Belt and you can actually feel its sides change shape.***

That's because the bending puts the top of the belt under *tension*, while the body undergoes *compression*. Naturally the sides of the belt *bulge out*—and if the belt is built with *straight sides*, you get the result shown in Figures 1 and 1-A, below:—

Straight-Sided V-Belt

How Straight-Sided V-Belt Bulges in Sheave-Groove.

Clearly, the bending forces a straight-sided V-Belt into a shape that does not fit the sheave-groove—and the bulging produces excessive wear along the *middle* of the *sides*.

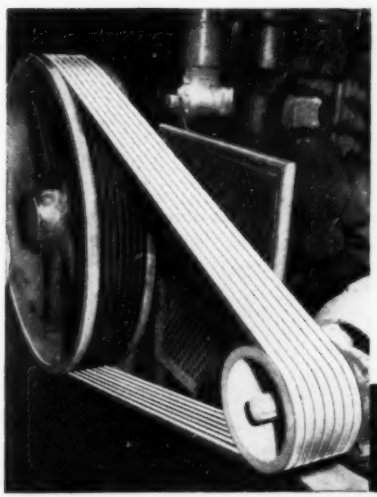
Now, bend the V-Belt built with the precisely engineered Concave Side (U. S. Patent No. 1813698)—the Gates Vulco Rope.

Gates Vulco Rope With Concave Side.

No Side Bulge. Precise Fit in Sheave-Groove.

You get the same shape change but *now* the new shape *exactly fits* the sheave-groove as shown in Figures 2 and 2-A.

Results—(1) *Uniform* side-wall wear; *longer* life. (2) *Full* sidewall grip on the pulley; carries heavier loads and sudden load increases without slippage — a big increase in drive efficiency — saving belt wear and also saving power!



## The Concave Side is *MORE IMPORTANT NOW* Than Ever Before

Because the *sides* of a V-Belt are what actually *drive* the pulley, it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley *directly* through the belt's side-walls.

Now that Gates *SPECIALIZED* Research has made available to you SUPER Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side naturally delivers greater savings today than ever before.

THE GATES RUBBER COMPANY
DENVER, U. S. A.
*The World's Largest Makers of V-Belts*

Gates
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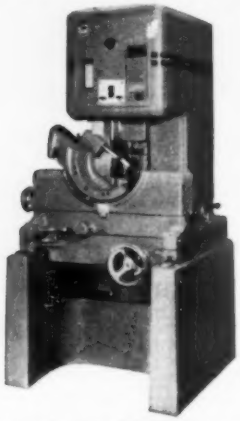
The Mark of SPECIALIZED Research

492

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS In the U. S. and 71 Foreign Countries

Kodak Conju-Gage, Model 8U, tests gears up to 8¼ inches in diameter. Smaller models check gears up to 1¼ inches and 4⅛ inches, respectively, in pitch diameter.



## STEP UP GEAR QUALITY— CUT DOWN ON MASTERS

● In precision checking of gears, a single Kodak Conju-Gage Worm Section takes the place of many master gears—yet costs about the same as one.

The Kodak Conju-Gage Worm Section is a gaging element produced by thread grinding to tolerances impracticably difficult to maintain in circular masters. It is accurately conjugate to spur or helical gears of any helix angle and any diameter as long as they have the same normal pitch and pressure angle. It can also test gears with different amounts of backlash.

What's more, the Kodak Conju-Gage Worm Section itself is easily checked for accuracy and can be reground repeatedly to its original specifications.

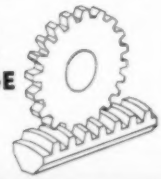
So here is the way to save on testing and at the same time stop rejecting good gears or passing poor ones. For the inherently greater accuracy of the Kodak Conju-Gage Worm Section as compared with circular masters insures your gear shop against "tolerance robbery."

To get full details about Kodak Conju-Gages—how they work . . . save gears and money, write to

**EASTMAN KODAK COMPANY**
**Industrial Optical Sales Division, Rochester 4, N. Y.**

**Kodak**
**CONJU-GAGE**

*"Kodak" is a trade-mark*



Kodak

## YOU CAN'T BEAT FULMER HONING

● ***THE FASTEST,*** *most efficient* and easiest method of finishing cylindrical bores ½" to 30" diam.

● ***FAST STOCK REMOVAL:*** It is the common practice for stocks of .015"-.060" to be removed in a fraction of the time required to set up the job for boring.

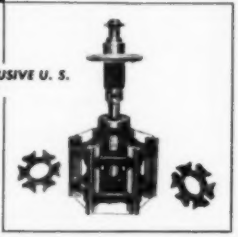
● ***EXTREME ACCURACY:*** Hold to ±.0001" tolerance on bore size, straightness, roundness, with any surface finish desired.

● ***ENGINEERED*** to give *maximum* production with *minimum investment,* Fulmer Honing Machines offer the *greatest* value in the honing field. Get full details today.

*Fulmer Model 15-48 honing 12½" x 42" Diesel liner. .012"-.015" of Gun Iron is removed in 10-12 min. Machine capacity 2"-15" diam.*

***FULMER COMPANY NOW EXCLUSIVE U. S. DISTRIBUTOR FOR ALEXANDER BALL HONING TOOLS***

Available in sizes from ½" to 50" diam.



● **WRITE FOR NEW 12 PAGE HONING BULLETIN.**

Fully illustrated. Gives valuable data on honing applications, Alexander Ball Honing Tools, and specifications on all models of Fulmer Honing Machines.

**C. ALLEN FULMER CO., 1234 First National Bank Bldg., Cincinnati 2, Ohio**

***Save Hands Speed Production with—***

## LITTELL
## Pres-Vac Safety Feeder

**KEEP workmen's hands out of Danger Zone. Use PRES-VAC Safety Feeders to keep hands safe, improve quality and speed production. Pres-Vac acts on trigger-vacuum principle. Picks up—drops—material instantly. Uses compressed air, 10 to 45 lbs. pressure.**

**Littell makes a complete line of pressroom equipment, including: Reels, Roll, Dial and Magazine Feeds; Straighteners; Air-Blast Valves; Scrap Winders, etc.** ***Request Bulletins.***

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**4169 Ravenswood Ave. CHICAGO 13, ILL.**

## RANDALL & STICKNEY
### *Universal Gauge*

***for rigid inspection of a wide range of parts . . .***

**An almost unlimited use is offered by this instrument for inspecting duplicate parts in quantity or any small parts with flat surfaces or recesses.**

**Use of standard blocks made possible by raising or lowering table increases capacity to take material up to 2" in height. Graduated to read to .001 inch; height 9¾"; weight 5 lbs. 1¼ oz.; depth from frame to spindle 1⅝".**

***Full details on request***

**Can be supplied with sliding head and table; also on a stand with throat 3" deep.**

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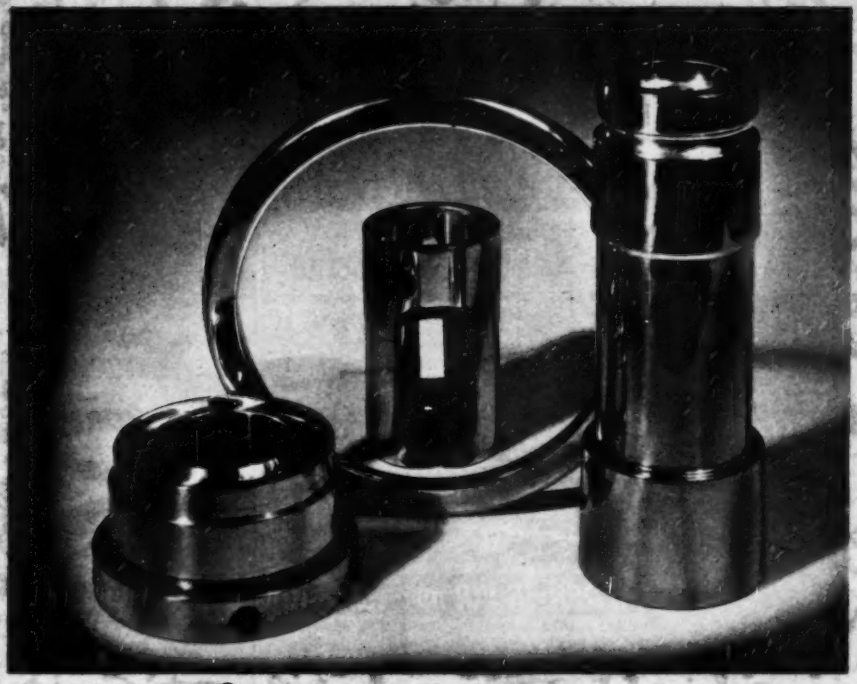
*Makers* *Waltham 54, Mass.*



If precision is your problem, sleeve bearings will solve it to the fullest extent... in modern aircraft engines and their superchargers—on the spindles of precision machine tools—where precision is paramount—Bunting Cast Bronze sleeve bearings are used... Versatile in design and alloy, Bunting Bearings offer advantages which we would like to discuss with you.

The Bunting Brass & Bronze Co., Toledo 9, Ohio. Branches in Principal Cities.

Bunting

BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS

42

# Precision Rod Cutting at High Speed

with the New

## DI-ACRO ROD PARTER

The DI-ACRO Rod Parter further increases the applications of "DIE-LESS DUPLICATING" as a cost-cutting, time-saving production technique so well established by DI-ACRO Precision Benders, Brakes and Shears.

**Do you require precision?**—The DI-ACRO Rod Parter holds tolerance to .001" on duplicated cuts. The ends are square, and roundness is maintained.

**Do you want speed?**—The Rod Parter exceeds output of other methods with equal accuracy, on rods and bars up to ⅝". Torrington Roller Bearings incorporated in an exclusive multiple leverage arrangement provide remarkable ease of operation in both heavy and light materials.

**"PARTS OFF" MANY MATERIALS**

All hot and cold rolled rods
Stainless steel
Chrome Molybdenum
Aluminum Brass
Copper Bi-metals
Many types of plastics
Fibre Rubber
Wood

**GET "DIE-LESS DUPLICATING" CATALOG**

Shows parts produced without die expense by DI-ACRO Benders, Brakes, Shears, Rod Parters, Notchers, Punches. Send for your free copy.

Pronounced "DIE-ACK-RO"

DI-ACRO DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.

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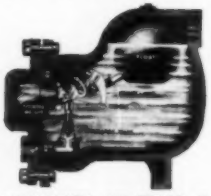
SERVICE RECORDS SHOW *It Will Pay to Investigate* THESE 4 NICHOLSON UNITS

# IF YOU'RE ALL-OUT TO CUT COSTS

On the basis of their service records, leading plants are increasingly standardizing on these Nicholson units. For details, send for the individual bulletins listed here.

NICHOLSON EXPANDING MANDRELS—Set of 14 does work of 209 solid arbors; sensational time savers in some operations. Sold singly or in sets; for bores ½" to 7". Bulletin 1043.



NICHOLSON ARBOR PRESSES—A precision tool for bending, pressing, assembling, broaching, etc. 5 sizes: for 5¾" to 20" diam.; light to 5 ton capacity. Bulletin 845.

NICHOLSON AIR TRAPS—For intercoolers, aftercoolers, receivers, tanks, etc. Extra large discharge capacity; positive seal over valve prevents medium loss; non-wire drawing; working parts of stainless steel. 3 types for pressure to 1500 lbs. Catalog 448.

NICHOLSON CYLINDER CONTROL VALVES—2, 3, 4-way and special types. All manner of operation. In metals for all mediums. Size, ¼" to 2½"; pressure to 5000 lbs. Catalog 546.

*Send for Bulletins Listed*

**W. H. NICHOLSON & CO., 114 Oregon St., Wilkes-Barre, Pa.**

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*Says*

## CHIP WRIGHT

"Looking for trouble is a necessary part of efficient operation, because the most efficient shop is one in which troubles are reduced to a minimum.

"A plant honing cylinder blocks was considered to be trouble-free when it was averaging 9.6 blocks per stone and getting a fair finish. However, when a change of honing oil made it possible to hone 15.4 blocks per stone and get a better finish, it was realized that there actually had been trouble before this profitable change was made.*

"That's what I mean when I say, 'Let's look for trouble.' Another way of stating it is: 'Where can we find opportunity for improvement?' Frequently the biggest single opportunity lies in the choice of cutting fluids."

—Chip

*The change that improved the honing operation cited above was a mixture of ThredKut 99 recommended by a D. A. Stuart Oil Co. representative. ThredKut 99 is easily mixed or blended whenever a special operation calls for its unusual qualities. Ask for a booklet on D. A. Stuart's ThredKut 99 and other time-tested cutting fluids.

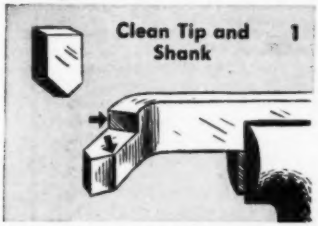
STUART *oil engineering goes with every barrel*

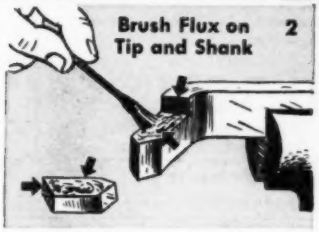
D. A. Stuart Oil Co.

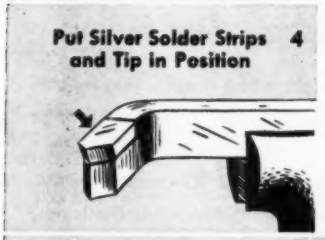
2729 S. TROY ST., CHICAGO 23, ILLINOIS

# HOW TO MAKE YOUR OWN TIPPED CUTTING TOOLS

The sketches below show how easy it is to make your own tools by silver brazing HAYNES STELLITE tool tips to steel shanks. There are 14 standard shapes of these tips stocked for immediate delivery. Write for a copy of "HAYNES STELLITE Metal Cutting Tools" which illustrates the sizes and types of tool tips available (use the convenient coupon below). You will find prices considerably lower than for solid or welded tip tools.






1. Clean both the tip and the recessed area of the steel shank by light grinding if necessary—then brush with carbon tetrachloride. Clamp shank in vise with bottom surface of recess level.

2. Brush silver-brazing flux generously onto the joint surfaces of both tip and shank.

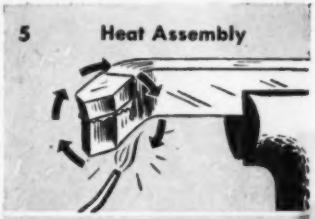
3. From 0.003-in. thick silver solder strip cut pieces slightly over-size for the joint faces of the recess.

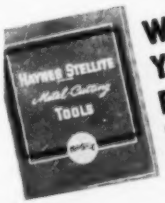
4. Position the brazing alloy strips and place the fluxed tip in the shank recess ready for heating.

5. Use an oxy-acetylene blowpipe with a reasonably large tip and adjust for a reducing flame. Heat the shank underneath the tip to a cherry red, rotating the flame from bottom to side to top to other side to bottom. (For large quantities of tools, you can do this heating in a furnace at approximately 1450 deg. F.)

6. When the silver alloy melts, move the tip with a rod or tongs into exact position, and then press it just enough to squeeze out excess flux and silver solder. Allow the assembly to air-cool. *Do not quench!*

7. When the assembly is completely cool, remove the excess flux and scale. The tool is now ready for grinding.



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Please send me, without obligation, your booklet, "HAYNES STELLITE Metal-Cutting Tools."

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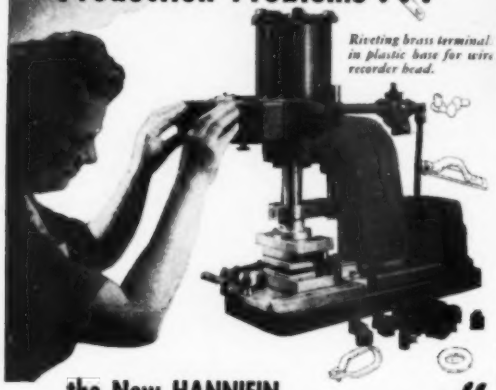
Solves "SMALL PARTS" Production Problems . . .



*Riveting brass terminal in plastic base for wire recorder head.*

the New HANNIFIN

"Han-D-Press"

air operated!

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STAKING

PUNCHING

PRESSING

ASSEMBLING

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**MORE WORK WITH LESS EFFORT!** You can do it better . . . faster . . . and cheaper with these new Hannifin Air Presses on the job! Safe; anyone can operate.

**LOOK AT THESE FEATURES!** Designed specifically to help you speed up light, but often troublesome, production operations:

- Electric push button control, hand or foot operated, through Hannifin's new exclusive fast-cycling 4-way solenoid valve.
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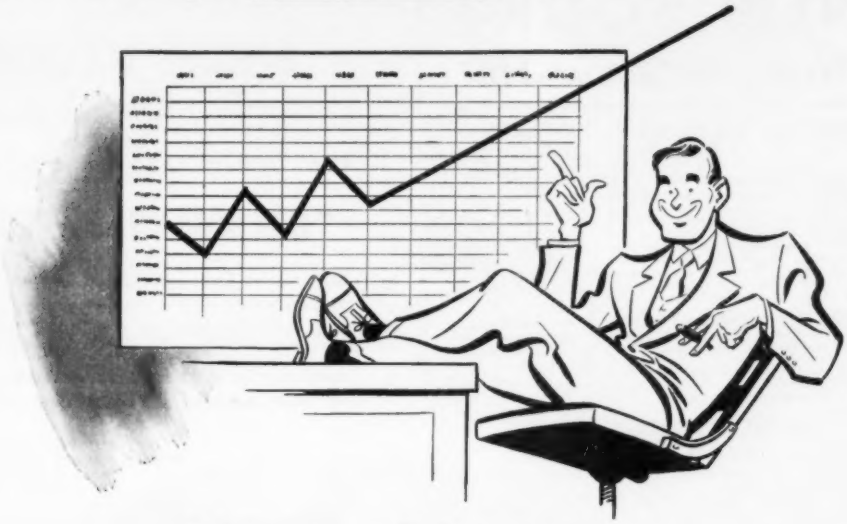

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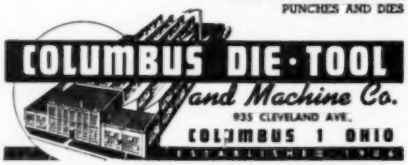




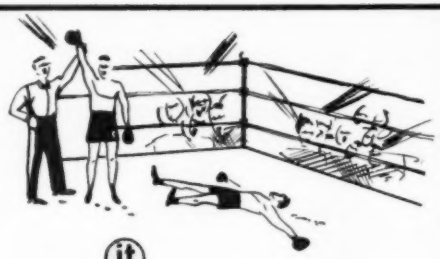

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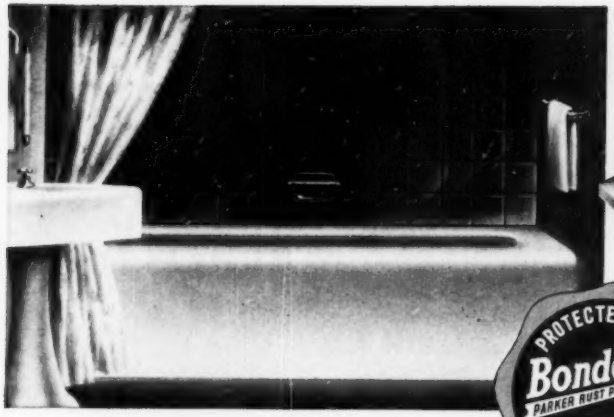

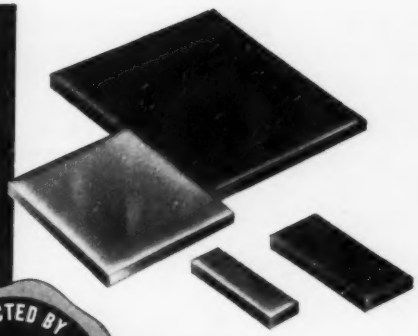

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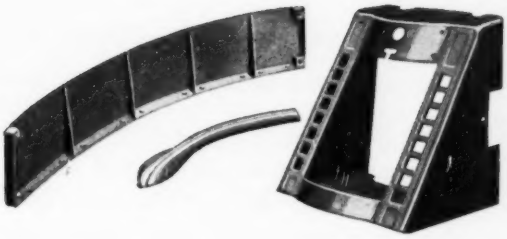

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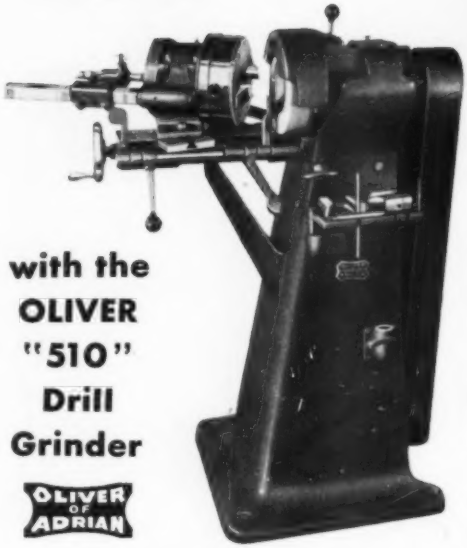

**with the OLIVER "510" Drill Grinder**

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It is a well known fact that a correctly sharpened drill does have more clearance near its center than at the outside edge, for the *angle of helix* of any given feed is greater as it approaches the center.

In the Oliver "510" Drill Grinder this important problem of point clearance is solved by moving the drill into the grinding wheel while revolving. This movement generates a perfectly proportioned clearance from the outside to the center.

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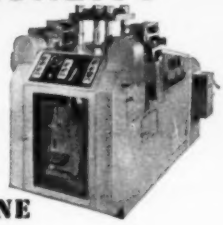

**with the *Speedmaster* DIEING MACHINE**

***How to reduce stamping costs to meet the competitive situation***

The Speedmaster is a high speed model Dieing Machine permitting the utmost in high production, without sacrifice of die life. It is especially adapted to the use of carbide dies—and can use all types of conventional and standard Dieing Machine dies with little or no modification. The Speedmaster embodies new features permitting ultra high speed operation, and has a fingertip variable speed control which permits the operator to adjust the machine to the ideal speed for optimum operation. This machine is especially suited to the high speed production of laminations, assuring clean, sharp edges. The precision of operation is a safeguard against chipping of carbide dies, in fact die life is increased manyfold on this machine. Send NOW for the new bulletin on this machine.

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## WITH SCULLY-JONES ADJUSTABLE-ADAPTER-ASSEMBLIES

FAST and EASY as 1-2-3

1. Release set screw in the side of spindle.
2. Release screw in nut.
3. Shorten or lengthen projection by turning the nut.

SPINDLE EXTENSION ASSEMBLIES—Styles 1800 and 1900—Furnished with Morse Taper Holes and Acme Threads on the shanks.

TENSION AND COMPRESSION TAP HOLDERS—Styles "C" and "D"—Used on multiple spindle tapping heads to compensate for variations in lead of different taps.

**In multiple spindle drilling and tapping,** save time and money; eliminate trouble and delays; adjust drills and taps fast and easy as One, Two, Three.

Set-up is not disturbed. Accuracy is assured as spindle screw retains the adapter in position, and key furnishes the positive drive. These adapters are carefully heat-treated and ground to assure concentricity.

For complete information refer to page 38, and 64 through 78 of Scully-Jones Tool Engineering Manual 500, or write for details.

CHOICE OF TAPERS—Adjustable adapter assemblies are furnished with Morse Taper, "USE-'EM-UP" or Stub Taper Holes. Acme Threads or Standard "V" Threads on the shanks.

**MOST STANDARD SIZES ARE CARRIED IN STOCK FOR**

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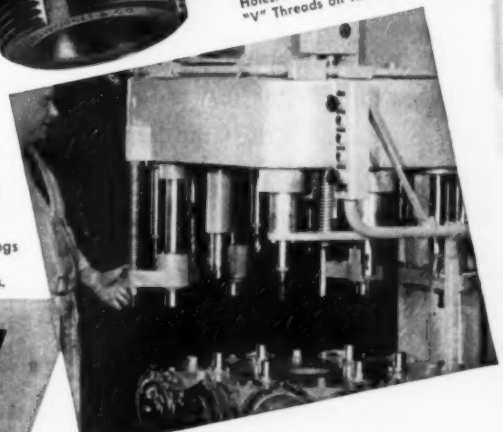
***Are You Planning SPECIAL TOOLING?*** If so, please send your drawings and specifications early. Prompt quotations will be made and delivery dates can be met, thus preventing delays in your production schedules.



TYPICAL APPLICATION—of Scully-Jones Adjustable Adapter Type Assemblies. Close-up of work head and index table of a Special Multiple Spindle Machine, Manufactured by The Cross Co., Detroit, Mich.

Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

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• This handy Weldon attachment measures directly the forward or reverse movement of the lathe carriage, within .001 of an inch. Easily attached to most lathes by drilling and tapping of one hole. • Dependable, accurate, convenient . . . saves time and reduces work spoilage.

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Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

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*Production*

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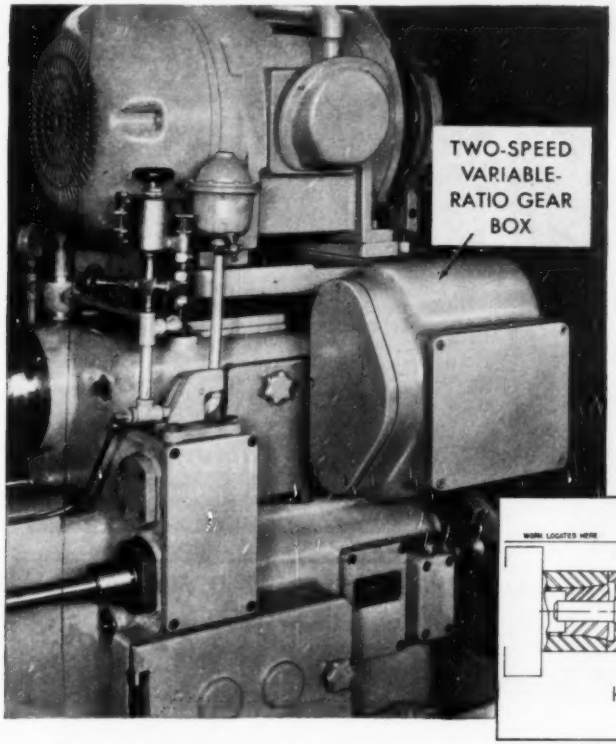
# MACHINE OF THE MONTH

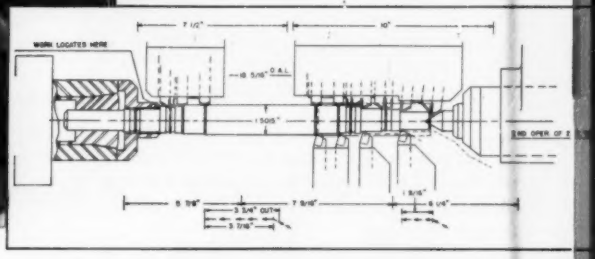
PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YOR




## Combined Turning and Squaring Operations at Different Cutting Speeds Now Possible with Lo-swing Automatically Controlled Two-Speed Headstock

*Left. View of two-speed, Variable-Ratio Gear Box with Belt Guards removed.*

*Below. Tooling layout for electric motor shaft.*




*Problem:* To turn, face and undercut shoulders on electric motor shafts, using cemented carbide tools for the turning operations and high speed steel tools for facing, grooving and chamfering operations which require a very smooth finish. Both operations to be made in one handling with automatic spindle speed change between the turning and squaring operations.

*Solution:* The Model "LR" Automatic Lo-swing Lathe selected for this job was equipped with a Two-Speed, Variable-Ratio, Gear Box shown in the illustration. The speed change from high to low and back to high again in a single machine cycle is controlled by two adjustable cams, mounted on the main cam shaft, which may be set to operate the multiple disc clutch at any time during the machine cycle. The ratio between the high and low speeds may be modified through pick-off gears to suit special conditions without removing or dismantling the gear box.

The tooling layout shows the second of two operations on a 1⅛" diameter electric motor shaft. The shaft is held and driven, on a previously turned diameter, in an air operated collet chuck which grips the shaft well in from the end, exposing only the part to be machined. This method reduces the shaft's effective length and eliminates springing due to the rigid grip of the collet. The work is positively located from a previously finished shoulder insuring accuracy of shoulder lengths.

The shaft diameters are turned with sintered carbide tools mounted on the front carriage, cutting at a surface speed of 350 ft. per minute. The squaring and forming tools are mounted on the rear slide and operate at a surface speed of 70 ft. per minute, insuring a very high polished surface on the shoulders and formed groove. This combination assures high production, coupled with smoothly finished shoulders, both of which are very desirable on electric motor shafts.

Consult Seneca Falls engineers for assistance in solving your automatic turning problems.

**SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.**

## PRODUCTION COSTS ARE LOWER WITH Lo-swing

# New Ettco-Emrick

**ELECTRIC-AIR CONTROLLED TAPPING MACHINE GIVES RESULTS!**

**PART:** Zinc die casting
**OPERATION:** Tap 5/8-16 hole in each casting
**PRODUCTION:** 2400 parts per hour plus

TWO big features make the new Ettco-Emrick Electric-Air Machine a must for any shop that does secondary tapping operations . . . (1) Versatility and (2) Speed.

The machine uses single and multiple spindle heads as well as adjustable spindle multiple heads. It takes only a few minutes to change head and workholder units to meet the needs of different jobs.

As for speed—the production on a typical job given above speaks for itself. Electric-air control is the answer. It provides full or semi-automatic operation—regulates depth of stroke—clamps work—operates work-holding fixture—ejects finished parts.

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MULTIPLE DRILLING & TAPPING HEADS
DRILLING & TAPPING MACHINES

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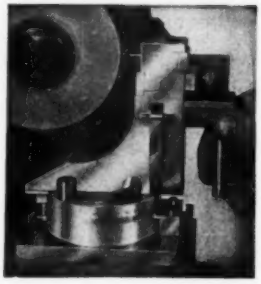

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• Fluidmotion Wheel Dressers are so simple to operate that even beginners can do the most intricate form dressing accurately. Two angles and a radius can be dressed in one continuous motion—after only one setting of the dresser. In the resulting form, angles and radii flow into each other without sharp changes of direction. These fine dressers are made of carefully selected alloy steels. Design and workmanship are of the highest quality. Several models available. Write for booklet and free form-checker.

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High Speed Full Muffle Furnaces designed for High Carbon and Alloy Steels. Also Semi-Muffle Furnaces for Low Carbon Steels, Preheating and Other Uses. Send for Catalog of Gas Furnaces, Burners, and other equipment.

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**The *Scleroscope* is the only hardness tester that takes in the entire range from the softest to the hardest metals without any adjustments.**

**MODEL D-1 DIAL TYPE**
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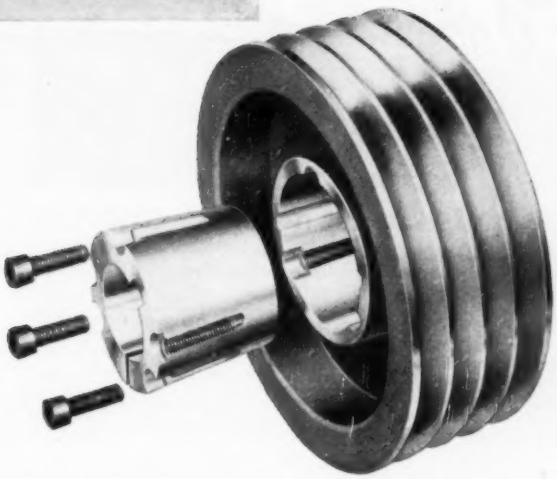
Holds fast to the shaft with firmness equivalent to a shrunk-on fit



No flange — no collar. Easy on, easy off. Slip it on and tighten while sighting

Stocked in complete range of sizes in Dual Duty (A and B); B, C and D grooves

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Look for the name of the Transmissioneer, your local Dodge distributor, under "Power Transmission Equipment" in your classified telephone directory.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

*PUSH!*

assembly work with a tool that's got *PUSH!*

"YANKEE" 130A Spiral with the Q-R spring

You get real *push* on an assembly job with a "Yankee" 130A. The spiral does the hardest part of the job. The quick-return (Q-R) spring in the handle keeps the bit in the slot, brings the handle back for the next push. Makes an easy, one-hand job of driving and drawing screws in awkward places ... overhead or down below or in narrow and "blind" spots. It's a big, sturdy, long-lasting tool ... a real value.

**More speed for the "Yankee" 130A with this "Yankee" Bit with Centering Sleeve.**

No time lost fitting bit into screw slot. This spring mounted bit automatically finds the slot and stays there. No slipping, burring or gouging. Two sizes, $\frac{7}{32}$" and $\frac{9}{32}$" wide at tip.

Sold by your industrial distributor
Write for the "Yankee" Tool Book

"YANKEE" TOOLS NOW PART OF
STANLEY
THE TOOL BOX OF THE WORLD

NORTH BROS. MFG. CO.
Philadelphia 33, Pa.



# TO TURN PROSPECTS INTO CUSTOMERS

*Give this!*

**THEY'LL CARRY IT—USE IT—AND REMEMBER YOU!**

**For a premium that will pay dividends,** give this new nationally known Nail Clipper. It's handsome, it's compact and it's useful to men and women alike. And because people tidy their nails every day, it advertises your company seven days a week, every week of the year. Not a toy! Not a gadget! A mechanically perfect instrument! Bright as a jewel, light as a coin. Slips into pocket or purse or through chain. Available in quantity at attractive low cost.

**AN INEXPENSIVE WAY TO MAKE FRIENDS AND GAIN CUSTOMERS!**

***For sample and information on low prices write, without obligation, to:***

**THE W. E. BASSETT CO.**
Dept. A-130 Derby, Conn.

# your industry's BIGGEST TRADE SHOW!

Your industry's biggest trade show isn't a once-a-year event. It comes to you with *every single issue* of this magazine. And, because it is scheduled so frequently, it can bring you a continuing series of up-to-the-minute "displays." In these advertising pages, you will find the latest news about products and services that are specially designed to help you do your job better, quicker, and cheaper. To be well-informed about the latest developments in *your* industry ... and to stay well-informed ... ***read all the ads too.***

**AMERICAN MACHINIST**

HEADQUARTERS FOR INDUSTRIAL INFORMATION

"50 Times Better"

# Talide
(TUNGSTEN CARBIDE)
## Drawing Dies

**TALIDE METAL MEETS EVERY REQUIREMENT**

PIERCING AND LAMINATION DIES

SWAGING DIES
*(For Forming Solid and Tubular Shapes)*

POWDER METALLURGY DIES *(For Compacting Powdered Metals and Materials)*

Talide Dies outwear steel dies 50 to 1. Production runs of over 1,000,000 pieces are commonly obtained. Long life of super-hard Talide Dies reduces down time, increases output, lowers unit cost and makes a better product.

Tungsten Carbide Dies take and hold a brilliant polish, thereby imparting a better finish to your product.

Talide Metal Dies range in size from pin point to 24" I. D., and in many complex shapes . . . used for blanking, drawing, swaging, extruding, spinning or curling.

*Send us prints or parts for estimate and recommendations and ask for Catalog 48-WP.*

BLANKING AND FORMING DIES
*(For Stamping Lamination Discs, Metals, Plastics, Paper)*

TUBE MANDRELS

HEADING AND EXTRUSION DIES
*(For Shaping and Sizing Bolts, Nuts, Screws and Collapsible Tubes)*

DRAWING DIES
*(For Wire, Tubing and Bar Stock)*

SPINNING AND CURLING ROLLERS

SINTERED CARBIDES — METAL CARBIDES CORPORATION — TALIDE — YOUNGSTOWN, OHIO — HOT PRESSED CARBIDES

# METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

CUTTING TOOLS · DRAWING DIES · WEAR RESISTANT PARTS

# WALTHAM CYLINDRICAL SUB-PRESSES

## *for precision work*

*Arch Sub-Press*

Provision is made for compensation for wear, so that the original alignment is maintained. This is especially important for producing precision or complicated parts. The long bearing surface also tends to increase precision and durability. Arch Sub-presses are designed for strip work. The Overhang type, with its better access and visibility, should be used for subsequent operations requiring hand positioning of the work.

*Overhang Sub-Press*

**WALTHAM MACHINE WORKS**
HIGH STREET, WALTHAM, MASS.

WALTHAM
TRADE MARK REGISTERED U.S. PAT. OFF.

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**ACROMARK MAKES**

**HERCULES HOLDERS & TYPE**
*FOR STAMPING PART NUMBERS INTO STEEL, CASTINGS, BRONZE AND OTHER METALS*

Also manufacturers of Marking & Numbering Machines, Steel Stamps, Name-Plates, Engraving Metal Signs, Marking Inks, Etc. *Write for Data to—*

ACROMARK Company
7-13 MORRELL ST.
ELIZABETH 4, N. J.

---

**60 YEARS MANUFACTURING**
Multiple Spindle Drilling and Tapping Machines — Automatic Drilling and Tapping Units — Multiple Spindle Attachable Drill Heads — Hot and Cold Swaging Machines — Hammering Machines — Tools, Jigs & Fixtures — Contract Work — Special Machinery
LANGELIER MANUFACTURING COMPANY,
PROVIDENCE 7, RHODE ISLAND

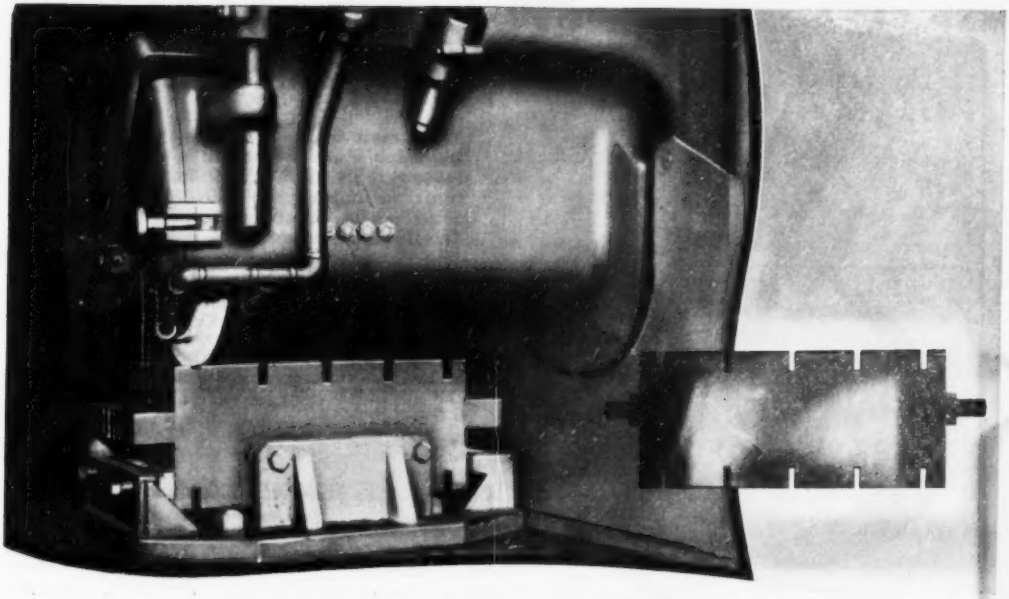
---

**ABRASIVE SURFACE GRINDERS**
ABRASIVE MACHINE TOOL CO., EAST PROVIDENCE 14, R.I.
AGENTS IN PRINCIPAL CITIES

---

**B & RB PRECISION BEARINGS**

Are selected for dependability and greater capacity. Standard sizes are carried in stock.
*Write for our general catalog.*
**THE BALL AND ROLLER BEARING CO.**
DANBURY, CONNECTICUT



# PLUNGE CUT GRINDING *Saves 90 minutes per plate*

## ELIMINATES MILLING OF SLOTS, REWORK AND SCRAP

● MACHINE: Mattison High-Powered Precision Surface Grinder with Automatic Down Feed.

MATERIAL: 1¼″ x 8¼″ SAE 1020 Steel ground to thickness, milled and ground to length, Heat Treated and Oil Quenched to Rockwell 50-55C.

PREVIOUS METHOD: Plates were rough milled to .468″ slot width and slot ground after heat treating. This method produced an excess of scrap because of slot distortion due to heat treatment.

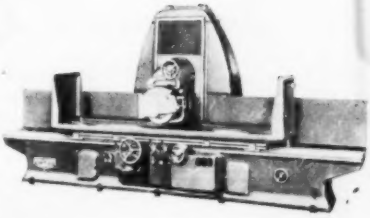
PRESENT METHOD: Twenty plates are assembled together and clamped to magnetic chuck. The slots .500″ wide by 1.250 deep are plunge ground to size, one slot at a time, with length gauge to determine spacing. Depth of cut is controlled automatically.

SAVINGS: The new plunge cut grinding method eliminates the milling of slots, rework and scrap. On the 1¼″ thick plates there is a saving of 90 minutes per plate, 105 minutes on the ¾″ and 110 minutes on the ½″.

WHEEL USED: Norton 20″ x .515″ x 8″ dia. hole No. 57A4605V dressed to .499″ plus .001″.

The high power, speed and ruggedness of construction and large capacity of Mattison Grinders are factors that make results like this possible. To determine what can be done with your work send us blue prints for production estimates.

*The above data on savings of time and material was effected by a Mattison Surface Grinder at the plant of Besser Manufacturing Co., of Alpena, Mich. The information was submitted by Mr. R. M. Douglas, Vice-Presidnet and Production Manager.*



Write for Free Set-Up Book showing how others have reduced time and cut costs with Mattison Grinders.

**MATTISON MACHINE WORKS**

ROCKFORD · ILLINOIS

## NUMBER ONE CHOICE IN THOUSANDS OF PLANTS

**There must be a reason why GORHAM is the number one preference in thousands of industrial plants. More and more manufacturers are turning to GORHAM High Speed Steel Tool Bits for all their cutting tool needs. This superior product has won its reputation through *performance* . . . by meeting the most exacting requirements on tough production jobs. ★ ★ ★ Try GORHAM High Speed Steel Tool Bits in *your* plant today. Learn why these tools do your work better, faster, and at lower cost. Immediate delivery—place your order now.**

**GORHAM STANDARD** for the Commercial Field

**GORHAM M-40-B** for Heavy Cuts in Hard Material

**GORHAM GORMET** for More Abrasive Materials

**GORHAM TOOL COMPANY**
14400 WOODROW WILSON AVE. • DETROIT 3, MICHIGAN

*The very best facilities for*

**STAMPINGS**

*In Small Lots*

DAYTON ROGERS
*Manufacturing Company*
Minneapolis (7), Minn.

BUY U.S. SECURITY BONDS NOW!

**CARLTON RADIAL DRILL**

FEATURES: 1. Low Hung Drive to Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all Speeds. 4. Concentrated and Convenient Push-button Controls. 5. Constructed on Unit Principle.

**THE CARLTON MACHINE TOOL COMPANY**
CINCINNATI 25, OHIO, U. S. A.

# CONTRACT WORK

TOOLS • DIES • JIGS • FIXTURES • MOLDS • STAMPINGS • FORGINGS • SPECIAL MACHINERY • DEVICES • PARTS • SCREW MACHINE PRODUCTS • CASTINGS


**SPIRAL BEVEL GEARS**

Production facilities available on late model Gleason generators.

**ARROW GEAR COMPANY**

Worth, Illinois Phone: Worth 370J2

**F. F. SLOCOMB CORPORATION**

Wilmington 99, Delaware

Builders of Special Machines a Specialty. Facilities Available for Production. Quantities of Small and Medium Precision Parts.

*Equipment List on Request*

*The Lowest Possible Die Cost For...*

**STAMPINGS**

**IN SMALL LOTS**

**DAYTON ROGERS MFG. CO.**

Minneapolis 7, Minnesota

**Put Your Idle Capacity to Work**

Hundreds of metal-working companies are finding profitable business today outside their regular lines. Tell metal-working America—the 100,000 readers of American Machinist—about your facilities. Write for rates.

**CONTRACT WORK DEPARTMENT**

AMERICAN MACHINIST

330 W. 42nd St., N. Y. 18, N. Y.

**PATTERNS in WOOD and METAL**

For All Kinds of Castings, Large or Small

MATCH PLATE WORK A SPECIALTY

Put your pattern problems up to us — we will take care of them.

**GENERAL PATTERN WORKS**

2233 Ruck Street Cincinnati, Ohio


# SEARCHLIGHT SECTION

## EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

**DISPLAYED RATE**

*(Not available for equipment advertising)*

**90¢ per line, minimum 4 lines. To figure advance payment count 5 average words as a line.**

**POSITIONS WANTED (full or part-time individual salaried employment only), ½ above rates.**

**PROPOSALS, 90 cents a line an insertion.**

**INFORMATION**

**BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 1 line additional in undisplayed ads.**

**DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).**

**The advertising rate is $9.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.**

**AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches to a page. A.M.**

*NEW ADVERTISING received by 10 A. M. February 8th will appear in the issue of February 24th subject to limitation of space available*

**ASSISTANT SUPERINTENDENT**

Assistant to Machine Shop Superintendent needed for large manufacturing concern in Appleton, Wisconsin. Permanent position with excellent opportunity for qualified applicant. Man with supervisory experience able to direct and supervise actual machine operations required. Must know tooling, cost reduction and production control. State experience, marital status, availability and salary required in first letter.

P-7770 AMERICAN MACHINIST

520 N. MICHIGAN AVE., CHICAGO 11, ILL.

**Are You Seeking or Offering**

**— business**

**— equipment**

**— employment**

**"OPPORTUNITIES"?**

**To fill any of these "industry wants" a logical source is found in this Searchlight Section—Classified Advertising.**

**Experience has shown that the Searchlight Section produces quick results because it spotlights current opportunities of special interest to the readers of AMERICAN MACHINIST—management and production executives in the metal-working industry.**

**Use "Searchlight"—at low cost—to feature your wants or offerings . . . whether it concerns employment, buying or selling used or surplus new equipment, or other pertinent business "opportunities."**

*REPLIES (Box No.):*
*Address to office nearest you*
*NEW YORK: 330 W. 42nd St. (18)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*

### POSITIONS VACANT

WANTED—FIRST class practical machine tool designer who has had experience in machine tools, preferably larger sizes. Good opportunity for capable engineer. We are an old established and successful company and build high grade machine tools. Plant is modern; located upper New York. P-7790, American Machinist.

WANTED: MAINTENANCE supervisor to act as assistant to Maintenance Superintendent; experience in heavy chemical industry essential; must have ability to get along with workers under Union contract, and be capable of supervising and instructing workers on machine repairs, proper pipefitting methods, and welding. Modern plant in West Virginia; excellent working conditions; stable employment. P-7758, American Machinist.

### SELLING OPPORTUNITY OFFERED

WANTED A person with connections, who can secure work for old established manufacturers of special machinery and tools. Also have own wood or metal pattern shop. Commission or share of profits without investments. RW-7178, American Machinist.

### SELLING OPPORTUNITY WANTED

MANUFACTURERS REPRESENTATIVE in the Pittsburgh district wishes to handle bar steel, sheet steel, forgings, cast steel and cast iron castings accounts. Fifteen years industrial sales experience in this territory. RA-7792, American Machinist.

### EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service. 39 years recognized standing and reputation. The procedure of highest ethical standards is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby Inc., 266 Dun Bldg., Buffalo 2, N. Y.

### BUSINESS OPPORTUNITY

**For Sale due to death of partner:**

A well-equipped machine shop in small, northwestern Ohio town. Machinery includes 4 punch presses, 3 lathes, milling machines, radial drills, drill presses, and all small equipment found in modern shop. Included are patent rights on power lawn mower, and building. Shop must be seen to be appreciated. Write Puls Machine Co., Milton Center, Ohio.

### CONTRACT WORK

**In position to accept**

additional Lathe work in Cincinnati territory at reasonable prices. CW-7867, American Machinist.

### PATENT ATTORNEY

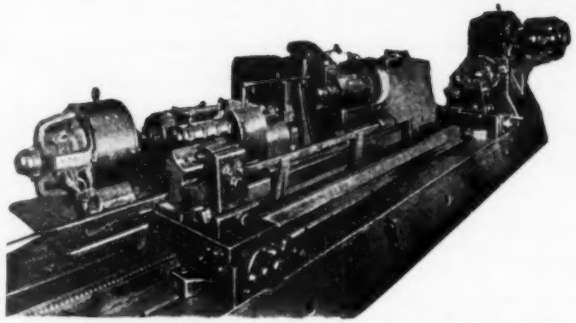
**Patent Practice**

before U.S. Patent Office. Validity and infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine and Rommel, Registered Patent Attorneys, Suite 453, 815-15th Street, N. W. Washington 5, D. C.

## SCARCE LATE MODELS

Cincinnati 1½" 3 spindle
TANNEWITZ DO ALL V26 BAND SAW #36M
3" UNIVERSAL HORIZONTAL BORING MILL, G & L 2ST, 45
Cin. Bick. 21" Super Service, 24"
DELTA SINGLE & MULTIPLE DRILL
Walker Turner Bench Drills ½"
Excelsior 21", Buffalo 18" Drills
GURTON DUPLICATORS 93, 81½'
GORTON ENGRAVERS 3U, 3L, 3Z, 4L, CUTTER GRINDERS
FELLOWS H.S. Gear Shapers #72, 725
BROWN & SHARPE #2, #5 SURFACE GRINDER
B & S #1, 2, 3 Univ. Grinders
Norton, B & S Tool & Cutter Gr.
Norton 6x18, 6x36" Type C Gr.
Norton, Thompson 6"x16" Surf. Grind., Hydraulic Feed, Reid 2B, 2C
G&L #18, 25, 33 Hyd. Surface
Abrasive #11½", 34 Surface
Gorton Cutter Grinders
Atlantic 6"x18 Surface Grinder
CINCINNATI 12x36" UNIV. GRINDER, HYDRAULIC, FILMATIC
#2 CINN. CENTERLESS, FILMATIC
Landis Centerless Thread Grinder
Covel #91A Tool & Cutter Grinder
H&W Radius Grinders 12"x36" Surface
Hammond & Excello Carbide Grinders
Gardner #226 Disc Grinder
Black Diamond Drill Grinder
Oliver 510, Sellers 4G Drill Grinders
LANDIS #6 THREAD GRINDER
Ball & Jewel Plastic Grinders, Cumberland
NILES BEMENT POND 2500 lb. Steam Hammer
Davis #4 Keycaster, #2 Baker
Hi Speed Hammers all sizes
BOYE & EMMES 20"x30" G.H. LATHE
Monarch 10x20" Lathe 12x30, 16x78
Hendey 12x30" G.H. Lathes
Lodge & Shipley 16"x28", 12 speed
S. Bend 9x31½, 13x36", 10x4, 14x6
Sebastian 12"x4' G.H. Lathe
LeBlond Regal 15" x 30, 16" x 31½', 21"x60', 16"x30" H.D.
Sheldon Lathe 11x36"
Hardinge, Rivett Precision Lathe
Cinn. & Schauer Speed Lathes
WARNER & SWASEY #3, 4 PRE-SELECTOR TURRET LATHES
Gisholt #4, 5 Univ. Turrets, Tooling
Morey #3 Turret Lathe
Acme #8W M.D. Faster 3B
Oster 661 Rapiduction Turret
Hardinge ESM 2nd operation
Brown & Sharpe #1, 2F Hand Screw
GORTON VERTICAL MILL 6D, 9J, POWER FEED & PLAIN
Milwaukee 2ML, 2H, 3H Pl. & Univ. Mills
Morey 12M Profiler 2 Sp.
Nichols Hand Mill Vert. Head
Van Norman Prod. Mill, Sundstrand
Burke #4 Mills Pl. & Univ.
Cinn. 1-12, 2-18 Prod. Mills
Brown & Sharpe #12 Electric, #000 Production Millers, #2 vertical
Van Norman #12, 26, 36 Duplex Head
Cinn. #3 Plain, #4 Vert. Dial Type
Kent Owens Mills #1V, 2-20
Reed Prentice #10D6 60Z, INJ. MOULDER
MARVEL AUTO. HACKSAW #6A, 4B
BLISS PRESS #58 OB Gap, 62, 62A, 102, 675, 100 Ton Hi Speed
Stokes Tablet Presses
V&O #102 Reducing Presses
Toledo 400 Ton Knuckle Joint Press
Diamond #31, 30 ton OBI Press
Bliss #4, 5½, Styles Presses
Thomas 80 Ton OBI
V&O, Z&H, OBI 25, 35 ton, 25B
CANEDY OTTO 5'x8' COL. RADIAL
American 3'9" Hole Wizard Radial
Reed Prentice 10D6 6 oz. Inj. Moulder
Oliver Heavy Die Filer, Fellows 725 Gear Shaper
Onsrud Router #W240
Micromatic Hydrohoner H-1
Waterbury Farrel #30 Thread Roller & Dies 1943
Porter Cable 6A Belt Sander
Bakewell #1, Ultramat Tappers, Haskins
Taylor Winfield 50 KVA Spot Welders
Thomson & Sciaky Seam & Spot Welders
Rafter Mod. 26 Tube Roller
Oliver 20" Woodworking Planer
Peerless #276, Eyeletting Mach.
Clark Hardness Tester

# AARON
## VALUES IN MODERN TOOLS



**NORTON ROLL GRINDER 50"x28' Centers. Motor Driven, actual swing 54". Bed divisible into two sections. *IMMEDIATE DELIVERY.***

### NEW IN STOCK
Power, Foot & Gap Shears—30" to 96"
8' 10 Ga., 6' 10 Ga., 6' 14 Ga.
Spot & Arc Welders, 6x6" Racine Hacksaw
4, 5, 7, 10, 12, 18 & 30 ton OBI Power Presses
Ammco 7", Shape Rite 8", Shapers
H.S. Vertical Milling Heads
Drill Presses, Foot Presses, Air Hydraulics
Kalamazoo Metal Band Saws
No. 1½ Abrasive Wet Surface Grinder
20 ton Northern Hydraulic Presses
10Z Injection Moulders
Famco 6C Arbor Presses—½ Price—Presses
Sheldon 12" B.G. Shaper

### AUTOMATICS
Cone 4 spindle, Gridley
Brown & Sharpe #4, 6 Auto., #2 Hand Screw

### BORING MILLS
#0 Giddings & Lewis arr. M.D. 3", Lucas 3½
2½" Cleveland arr. M.D., 2½", 4" Bimsee
Niles-Bement-Pond 4" duplex, 66" Niles
Bullard New Era 24", 42", King 42"

### GRINDERS
Surface Grinders, 6x18, 8x24, Abrasive, G.&L., B.&S.
P. & W. 14", B.B., Vert. Surface 19"x49"
Blanchard 30", M.D., Modern 12x48" M.D.
Norton Hydraulic 12x18", MD. Cyl.
Heald No. 72A3 Gagematic, Heald Tool Grinder
Norton 50"x28' M.D. Roll Grinder, 26x120
Landis Type A 8x20" Hydraulic, M.D. Cyl.
No. 55, 60, 65 Heald Int., M.D.
12" Heald Rotary, Arter 12" M.D.
B. & S. No. 10, 11, Cyl.: 1, 3 Univ.
Landis 20x96 Crankshaft Grinder

### LATHES
14"x6' Hendey Taper, Collets 16"x8'
9" LeBlond, P&W 1"x18" Automatic
36x30' Putnam M.D., 36x22', 42x16
32"x35' Wickes, M.D., American 20"x18" GH, TA
Wade, Hjerth, Hardinge, P & W Precision Bench

### MILLING MACHINES
3B K. & T. Dbl. Overarm
Cleveland Vert. No. 1 M.D.; #1 Univ.
#2B K. & T. Univ.; No. 2, 2A B & S Univ.
No. 3B Cincinnati, S.P.D. rapid trav.
Nos. 1½, 2, 5 B & S Plain & Univ.
Hall Planetary Model D Thread Miller, Hansen Whitney
Becker Nos. 1, 4B, 5, 6 Vert.
Nos. 2, 3, 4 Cincinnati Vert., S.P.D.
U. S. Hand Mills, U. S. Multimillers
P & W No. 12, 1 & 2 spind. Profiler
B. & S. No. 1, 3 Vert. Kempsmith No. 1, 2
Taylor-Fenn Spline Miller

### HYDRAULIC EQUIPMENT
**500 TON LAKE ERIE PRESS**
Platen 35"x36", 36" stroke, 68" opening, 150 H.P. 220-440 V. Motor.
600 Ton Baldwin South. Platens 76"x30, Stroke 22", Opening 30".
500 Ton H P M. Double Action with 166 ton cushion. Platen 36"x36", Stroke 24", Opening 36".
1000 Ton French-Oil Bed 53x42", stroke 20" daylight 58".
Brand New 300 ton Watson-Stillman Hobbing Press & Pump.
375 Ton ELMES Double Action, with 60 ton cushion. Platen 84"x44", 12" Stroke, 42" Opening.
**350 TON VERSON PRESS**
40x40 Platen, 36" stroke, 72" opening, 100 H.P. 3 phase—60 cycle 440 volt.
**400 & 500 TON SHAFT STRAIGHTENERS, Self Contained**

All Hydraulic equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your hydraulic problems.

### RADIALS
Carlton 8' Arm 19" col. M.D., 3½' Mueller
4', 5', 6' American Triple Purpose
Walker-Turner ½" cap., Cinn. Bick. 6'

### TURRET LATHES
Foster Nos. 4, 5, 6, 1B, 3B, M.D. Univ.
J. & L. 2"x24", 3"x36", W & S #4, 2A

### MISCELLANEOUS
Buffalo 25UD Comb. Punch-Shear
Pexto 3' to 8' Shears & Brakes
Gorton 1A; 375-2 Tool & Cutter Grinders
Wiedman Turret Punch—Type R4P
6" Vertical Shaper, P & W
10x10 Peerless Universal Shaping Saw
#7, 72, 725 Fellows Gear Shapers
Dockel GI, GIF Engraving machine
Leland-Gifford 1, 2 & 4 spindles, Model MS
Geo Ohl 8' 10 Gage M.D. Shear, 12' 10 Ga. Brake
Oster No. 316B 6" Pipe Threader, M.D., 304 4"
Bliss 30" Gang Slitter, 1B, 2D, 2E OBI Presses
Double End Buffers, 1HP, 5HP
K.B.W., Lemco Hyde, Arbor Presses
McCabe Pneumatic Flanger

***WRITE FOR OUR FREE ILLUSTRATED CATALOG***

## AARON MACHINERY CO., Inc.

45 Crosby Street
WOrth 4-8233

New York 12, N. Y.
Cable: AARMACH, N. Y.

MDNA MEMBER

BUY FROM STOCK
Telephone
MAIN 6347-6348

# FALK
## MACHINERY COMPANY

18 WARD ST.
ROCHESTER 5
N. Y.

*Every Item Guaranteed as Represented*

**Warner Swasey #3 Universal Geared Head Bar Feed Ram Type Turret Lathe. 3/60/220/440 volts Motor Drive. FIVE AVAILABLE FOR IMMEDIATE DELIVERY. Some have Turret Tooling Equipment. EXCELLENT CONDITION. LATE TYPE MACHINES.**

### TURRET LATHES

Morey #2 Geared Head 1" Cap., M. Dr.
Simmons Microspeed 1" Cap., M. Dr.
Oster #601 Hand Screw Machine 1½ cap.
W-Swasey #4 Univ. 1½" cap., M. Dr.
Jones & Lamson #3 Univ. Bar Feed, 1½"
W-Swasey #3 Univ. 1½" cap., M. Dr.
Gisholt #4 Univ. 2" cap., M. Dr.
W-Swasey #2A Univ. 2¼" Cap., M. Dr.
Bardons & Oliver #7, Univ. 2½" Cap.
W-Swasey #3A Univ. 3½" cap., M. Dr.

Buffalo #0 Bending Rolls. Pinch Type, motor driven. With formers for bending angles, rounds, squares, pipe.
Buffalo, #1 Wrapping Rolls. Motor driven. Capacity— 3½x3/8x9
Niagara Initial Type. 12'x1/16" capacity.

Porter-Cable 12"x18" Mechanical CARBO-LATHE. Semi-Automatic. 63 spindle speeds, 95 to 1130 r.p.m. Collet capacity —1". 3/60/220 volts motor drive

### ENGINE LATHES

36"x30' LeBlond Geared Hd. Motor Dr.
32"x16' Bridgeford, Geared Head, M. Dr.
28"x10' Davis Quick Change Gear
26"x18' Bridgeford, Geared Head, M. Dr.
25"x14' LeBlond Motorized
24"x18' American Q.C.G. Grd. Hd. 11' centers, Taper Attach. Motor Dr. Equipment
24"x14' Lodge & Shipley, Motorized
24"x16' American Motorized
24"x12' Putnam, Quick Change Gear
24"x10' LeBlond, Quick Change Gear
21"x18' LeBlond, Motorized
20"x11' Schumacher-Boye, Q.C.G.
20"x10' American, Q.C.G. 72" centers
20"x10' Hendey, Q.C.G. motor dr.
20"x8' Lodge & Shipley, Q.C.G. M. Dr.
18"x10' American Geared Head
18"x8' Davis Q.C.G. 42" centers, equipment
18"x8' Lodge & Shipley, geared head
18"x8' Hendey Q.C.G. 49" centers
18"x7' Lehman, Q.C.G. M. Dr.
18"x6' American, Geared Head, M.D.
16"x8' Hendey Q.C.G. M. Dr.
16"x6' Lodge & Shipley Geared Head
16"x6' Lodge &Shipley "Patent Head", Motor Dr.
16"x6' South Bend Enclosed Head, Motor driven. Taper Attachment, Chucks, Collets & Quick Acting Collet Chuck.
14½"x6' South Bend Enclosed Head, Motor Driven. Taper Attachment, chucks, Turret Toolpost Threading Dial, Ram Type Turret Attachment, collets & Collet Chuck.
14"x8' Rockford, Q.C.G. Collets
14"x6' LeBlond, Q.C.G. M. Drive
14"x6' Mulliner-Edlund, M. Drive
14"x6' Hendey, Q.C.G. M. Drive
14"x6' Rockford, Q.C.G. M. Drive
13"x5' South Bend Q.C.G. 30" centers
12"x30" American Wood Spinning
12"x5' Sidney, Geared Head
12"x5' Hendey Q.C.G. M. Drive
12"x5' Hendey Motorized. Taper & Collets.
12"x5' Sebastian Q.C.G. Grd. Hd.
12"x5' Mulliner Motorized. Taper Att.
12"x3' Craftsman, Bench, M. Drive
12"x18" Porter-Cable Carbo-Lathe
11"x4' Sidney, Q.C.G. Floor Type

### GRINDING MACHINES

J & L #TG-615 Automatic Thread, M. Dr.
Norton 6x18 Vert. Surface, Excello Spindle
Norton 6x18 Horiz. Surface, Excello Spindle
Brown & Sharpe #2 Auto. Surface, 6x18
Pratt & Whitney 14x36 Vertical Surface
Blanchard #16, 26" Vertical Surface
Thompson Hydraulic Horiz. Surface
Abrasive Automatic Surface 22x8
Reid #2 Automatic Surface, 6x18
Norton Hydraulic Horiz. 6x36
Heald #25 Rotary Surface
New Leach 6x12 Horiz. Surface, 3/60/220 volts
Brown & Sharpe #2 Face, motorized
Rivet #3 Internal, Cone driven
Heald #70 Internal, Belt drive
Heald #60 Internal, Belt drive
Norton #2 Univ. Tool & Cutter, Belt Dr.
Cincinnati #1½ Univ. Tool & Cutter, Belt Dr.
Oakley #3 Tool & Cutter, Belt Dr.
G & Livingston #4 Tool & Cutter
Cincinnati #2 Tool & Cutter, M. Dr.
Cincinnati "Monoset" Tool & Cutter
Cincinnati #2 Centerless, M. Dr.
Garton Dble. End Disc, 18" dia. discs
Besley Dbl. End Disc, 30" dia. discs
Greenfield #12 Internal Hydraulic
Cincinnati #2 Univ., Cylindrical 6x36
Brown & Sharpe #10 Cylindrical 6x18
Brown & Sharpe #11 Cylindrical 10x30
Brown & Sharpe #4 Univ. Cylindrical 12x60
Brown & Sharpe #5 Plain Cylindrical
Oliver of Adrian #51 Drill Grinders

### AUTOMATICS

No. 0 & No. 00 Brown & Sharpe
No. 0 Brown & Sharpe Automatic Cutoff
#2 Brown & Sharpe High Speed Automatic.
Cleveland Model "A" 3¼" capacity Single Spindle Motor Driven Automatic. Has lot of tooling, collets, motors and switches & coolant system.

### PUNCH PRESSES

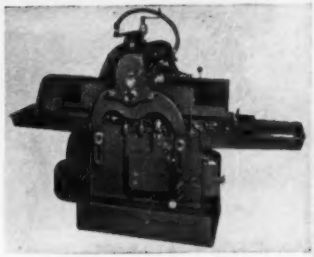
Caldwell 200 tons Horiz. Hydr. Wheel Press.
Niles Bement & Pond Horiz. Hydraulic Wheel Press.
Bliss #18, #20, #20B, #21 O.B.I. Motorized.
Ferracute #86 Wide Frame, motor driven. 61½" between housings. 1¾" stroke.
Michigan O.B.I. 36 tons cap. 2" stroke. Wide Ram, wide Bed. Motor driven
Bliss No. 68C Dbl. Action, Gap Frame.
Lucas 15 tons, Power Arbor Press. M. Dr.
Hub O.B.I. 15 tons, 2" stroke, M. Dr.
McCall No. 4 O.B.I. 2½" stroke, 25 tons.
NEW Johnson O.B.I. Presses. All sizes.
Bliss #305 Geared S.S. Single Action
Nilson 56 tons S.S. Dbl. Crank 3-Die Transfer Press
Rousselle #15 Horn Press. Motor Driven

### SHEARS

Bliss #109 Slitter, 10 ga. cap. Motorized
Pexto #571 Slitter, 3/16" cap. Motorized
Wais & Roos 10'x¼, 15' gap. Motorized
NEW Famco 36"x18 ga. Squaring
Niagara #8G Gap Squaring Shear. Cap.—96"x3/8". Motor driven. Front and rear gauges & extra set of blades. 18" gap.
Niagara #152 Squaring Shear. Cap.52½"x18 ga. Motor driven. Front gauges.

### GEAR CUTTERS

Fellows #72 High Speed Gear Shaper, Internal & external, Motor driven
Fellows #7 High Speed Gear Shaper, External, Motor driven
Brown & Sharpe #3—36 Automatic Gear Cutter, 36" dia. Motor driven
Brown & Sharpe #34 Gear Hobber. 5" dia. Motor driven
Barber-Colman #3 Gear Hobber, 5" dia. 7" face, Motor driven
Whiton #1 Automatic Gear Cutter, 34" dia. 7" face, Motor driven
Adams #1 Gear Hobber, 14" dia. 6" face, Motor driven



Cincinnati #2-18 Automatic Horizontal Milling Machine. Late Type, Motor driven with motor and controls. Motor driven coolant system. FIVE AVAILABLE.

### MILLING MACHINES

Vernon #0 Hand, Late Type, M.D.
Nichols Hand, Late Type, M.D.
Sundstrand #0 Rigidmil, M.D.
Whitney #6 Hand, Cone Drive
Hardinge B.B. Vertical, Bench
Bickett #1 B.B. Vertical, Bench
Ames Universal Horiz. Bench
Becker #5C Vertical, Cone Dr.
Knight #1½C Vertical
Cincinnati #3 & #4 Vertical
Cincinnati #2 Univ. Horizontal
Cincinnati #3S Univ., Horizontal
Cincinnati #3, #4, #5 Pl. Horz.
Cincinnati #2M Univ. Horiz.
Brown & Sharpe #12 Production. 18" Autom.
Brown & Sharpe #12 Production. 24" Autom.
Brown & Sharpe #0, 1, 1Y Horizontal
Brown & Sharpe #2 Univ. Horiz.
Brown & Sharpe #1D Univ. Horiz.
Brown & Sharpe #3 Univ. Horiz.
Kempsmith #1, #2 Plain Horiz.
Cincinnati 18" Mfg. Plain
Milwaukee #2K Vertical, M. Dr.
Milwaukee #3K Vertical, M. Dr.
Milwaukee #1½ Dbl. Overarm, Horiz.
Milwaukee #2B Dbl. Overarm, Horiz.
Milwaukee #2B Universal Horiz.
Milwaukee #3B Plain Horizontal
Pratt & Whitney #2 Duplex, Motorized
Cincinnati #0-8 Vertical, M. Dr.
Cincinnati #0-8 Plain Automatic Horiz. Some with rise & fall spdle.
Cincinnati #2-18 Plain Automatic

### SHAPERS & PLANERS

Shaper—Columbia 32" B.G. Crank, motorized. Power downfeed to head.
Shaper—Logan 7" Horizontal, NEW
Shaper—Machinery Sales 16", motorized
Shaper—Gould & Eberhardt 16", motorized
Shaper—Smith & Mills 16", motorized
Shaper—Smith & Mills 16" Universal
Shaper—Gould & Eberhardt 18" B.G. Crank
NEW—Gemco 20" Universal Shaper. M. Dr.
Shaper—American 24" crank, motorized
Planer—Shaper—Niles-B. Pond 20x20x24
Planer—Betts 72x60x30 Modern 4-Head
Planer—Betts 72x60x25 Modern 4-Head
Planer—Betts 122x72x34 Modern 4-Head

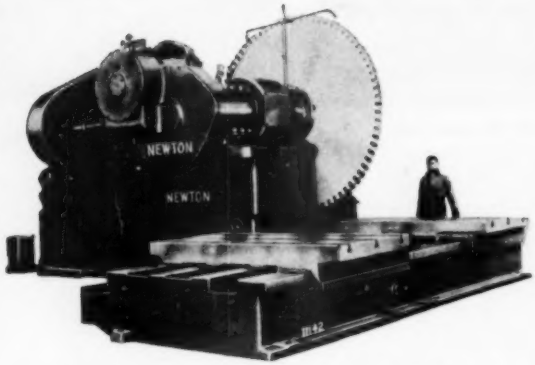
### DRILLING MACHINES

American 8' Triple Purpose Radial, M. Dr.
Cinci-Bickford 6' Arm, 15" col. Radial
Cinci-Bickford 5' Arm, 13" col. Radial
American 4' Triple Purpose Radial, M. Dr.
Fosdick 5" Arm 14" col. Radial
Demco 4-Spindle Drill #2 M. T. M. Dr.
Natco #12, 20 Spdle. Multiple, 3/16" cap.
Minster #2D Single Spindle Upright Heavy Duty 2½" cap. Compound Table. Motorized
Canedy-Otto 21" Single Spdle. Late Type
Cinci-Bickford 21" Drilling & Tapping, #3 m.t.
Buffalo Forge #2MS Drill. Late Type
Barnes 22" Backgeared Upright Single Spdle.
Leland-Gifford #2MS, 2-Spindle Upright
Edlund #2B, 4-Spindle Upright, #3 m.t.
NEW Buffalo Forge #15, #18 Single Spdles.

ENGINEERED REBUILT MACHINE TOOLS

BUILT MACHINE TOOLS

## FOR HEAVY TOOLS... SEE SIMMONS




120" Newton Type U-97-A Heavy Duty Cold Saw. Hydraulic Screw Feed. Two Adjustable Cast Steel Work Tables. 75-H. P. Motor and Control. One Inserted Tooth Blade. Capacity 44" Diameter Round Stock.

### PUNCHES & SHEARS

¾" x ⅜" Punch, 25" Throat
⅜" x 8" Shear, 36" Throat
⅝" x ⅝" Punch, 42" Throat
⅜" x ⅜" Punch, 36" Throat
1¼" x 1" Punch, 48" Throat
1¾" x 1⅛" Punch, 60" Throat
1⅛" x 1" Double End, 48" Throat
¾" x ¾" Punch, 48" Throat
1¾" Capacity Canton Alligator
1/16" x 10' Squaring Shear
#1 Buffalo Angle Roll 3" x 3" x 5/16"
3" x 3" x 5/16" Angle Shear
#215 Stoll Rotary
165 Ton Double Geared Guillotine with 14" Blades
12' Pneumatic Flanging Clamps

Write Today For Complete Current Stock List of Simmons Engineered-Rebuilt Machine Tools.

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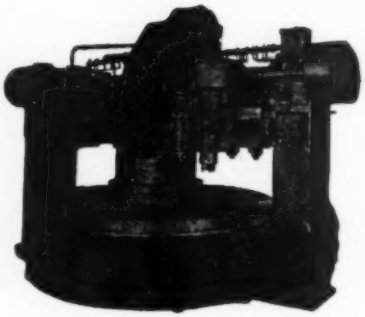
MAIN OFFICE AND PLANT 17TH AVE. BROADWAY & BABY 7 N.J. NEW YORK OFFICE 1 EAST 42ND STREET
ENGINEERED Machine Tool REBUILDING

## Newton Type V-4 Continuous Rotary Milling Machine



Equipped with 2 double heads, and 2 single heads, diameter spindle sleeves 6⅜" complete with 25 H.P. motor.

An ideal machine for continuous production of cylinder blocks, bases and a multitude of similar parts.

**EMERMAN MACHINERY CORP.**
875 W. 120TH ST. CHICAGO 43, ILL.

## NEW SURPLUS REAMER SETS

Sets #0-10 Pin Reamers. 11 Reamers in Box. per set $7.50

Sets A-H Critchley Type Expansion Reamers. 15/32" to 1-1/16", 8 Reamers in Wd. Box. per set $16.50

Sets I-L Critchley Type Expansion Reamers. 1-1/16" to 1-25/32". 4 Reamers in Wd. Box. $16.50 set

Sets ¼" to 1¼" by 32nd Hand Reamers. 33 Reamers in Wooden Box. per set $30.00

Sets ¼" to 1" by 16ths Hand Expansion Reamers. 13 Reamers in Wooden Box. per set $32.50

Sets ⅛" to 1" by 16ths H.S. Machine Reamers. ⅛" to 9/16" Straight Shank. ⅝" to 1" #2 M.T.S., 21 Reamers in Wooden Box. per set $35.00

**VICTOR MACHINERY EXCHANGE, INC.**
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- DEPENDABILITY
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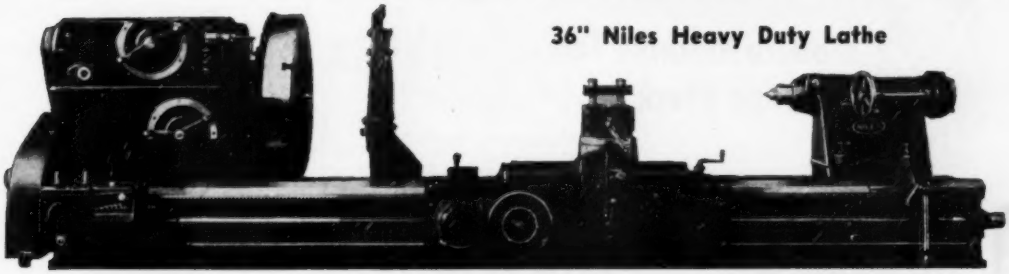
- LATE MODEL MACHINES
- GUARANTEED EQUIPMENT



36" Niles Heavy Duty Lathe

### ENGINE LATHES

10x20" centers Monarch EE Geared Head, m.d., latest
10x24" Lodgan, cone, motorized
13x30" centers Pratt & Whitney Model B, m.d., taper
13x48" centers Pratt & Whitney Model B, m.d.
14x30" centers Lodge & Shipley Selec. Head, m.d., latest
14"x54" centers Bradford Geared Head, m.d., taper
14"x6' bed Hendey Geared Head, m.d., taper
14"x6' Pratt & Whitney, cone
14"x6' LeBlond, cone
14"x6' Sidney Geared Head, m.d.
14"x6' Springfield Geared Head, m.d., taper
14"x8' American Geared Head, m.d.
14"x8' Pratt & Whitney, cone
15"x6' LeBlond Geared Head, m.d.
16"x14' American Geared Head, m.d.
16"x36" Pratt & Whitney Geared Head, m.d.
16"x6' Bradford, cone
16"x6' Hendey Geared Head, m.d.
16"x6' Hendey Yoke Head, taper
16"x6' Lodge & Shipley Selec. Head, m.d.
16"x6' bed Monarch Geared Head, m.d.
16"x10' Hendey Yoke Head, taper
17"x6' LeBlond Geared Head, m.d.
18"x52" centers American Geared Head, m.d., taper
18"x5' LeBlond Geared Head, m.d.
18"x7' Hendey Geared Head, m.d., taper
18"x8' American Geared Head, m.d.
18"x8' Hendey Geared Head, m.d.
18"x8' Lodge & Shipley Selec. Head, m.d.
18"x8' Lodge & Shipley Cone Head
18"x8' Whitcomb-Blaisdell Geared Head
18"x10' Cincinnati, cone
18"x10' Lodge & Shipley Selec. Head, m.d.
19"x8' bed LeBlond Geared Head, m.d., taper
19"x10' LeBlond Geared Head, m.d., taper
20"x8' American Geared Head, m.d., taper
20"x8' Cisco, cone
20"x10' Sidney Geared Head, m.d.
20"x11' Lehmann Geared Head, m.d., taper
21"x12' bed LeBlond Geared Head, m.d., taper
21"x18' LeBlond, cone
21"x18' bed LeBlond Geared Head, m.d., taper
21"x21' bed LeBlond Geared Head, m.d., taper
22"x70" centers Greaves Klusman Geared Head, m.d., taper
22"x8' Lodge & Shipley, cone
23"x12' LeBlond Geared Head, m.d., taper
24"x10' Hendey Geared Head, m.d.
24"x10' American, cone
24"x10' Greaves-Klusman Geared Head, m.d., taper
24"x10' Lodge & Shipley, cone
24"x12 Bridgeford Geared Head, m.d., taper
24"x12 LeBlond, cone
24"x12' Monarch Geared Head, m.d., taper
25"x10' LeBlond, cone
26"x12' Bridgeford Geared Head, m.d., taper
27"x48 centers Monarch Geared Head, m.d.
30'x12'6" Niles-Bement-Pond, m.d., taper
30"x13'6" Niles-Bement-Pond, m.d.
30" raised to swing 36"x20' American Geared Head, m.d., taper, Timken
32"x12' Lehmann Hydratrol Geared Head, m.d., taper, latest
26"x32' centers Putnam Geared Head, m.d.
36"x36'6" Niles Heavy Duty, m.d., latest, 2 carriages
50"x204" centers LeBlond Geared Head, m.d, taper, latest

### PLAIN MILLING MACHINES

No. 000 Brown & Sharpe, m.d., latest
No. 1A Milwaukee, m.d.
No. 1M Cincinnati, m.d.
No. 1½, 2, 3 Cincinnati, cone
No. 2B Brown & Sharpe, m.d., latest
No. 2 Cincinnati H.S. Dial, m.d., latest
No. 2 Rockford, m.d.
No. 2HL MBilwaukee, m.d., latest
No. 2MH Cincinnati, m.d., latest
No. 3B Brown & Sharpe, m.d., late
No. 3 Cincinnati, cone
No. 3, 4 Kempsmith Plain Maxi-Miller, m.d.
No. 3B Milwaukee, m.d.
No. 3 Van Norman Duplex, s.p.d.
No. 4 Cincinnati H.P., m.d.
No. 4 Ohio, cone
No. 5 Cincinnati, rect. overarm, m.d.
No. 5 H.D. LeBlond, s.p.d.
No. 5B Heavy Brown & Sharpe, m.d.
No. 25 Becker, cone

### UNIVERSAL MILLING MACHINES

No. 2 Cincinnati, cone
No. 2 Cincinnati Medium Speed Dial, m.d., latest
No. 2M Cincinnati, m.d.
No. 2 Kempsmith, cone
No. 3 Brown & Sharpe, cone, motorized
No. 3 Kempsmith, cone
No. 4A Brown & Sharpe, m.d.
No. 4 Cincinnati H.P., m.d.
No. 4G LeBlond, s.p.d.

### VERTICAL MILLING MACHINES

No. 08 Cincinnati, m.d., latest
No. 2M Cincinnati, m.d.
No. 2, 3, 4 Cincinnati H.P., m.d.
No. 2, 3, 4 Cincinnati High Speed Dial, m.d., latest
No. 2, 3 Cincinnati Medium Speed Dial, m.d., latest
No. 2H, 4H Milwaukee, m.d., latest
No. 2HL Milwaukee Swiveling Head, m.d., latest
No. 2K, 3K, 4K Milwaukee Dial, m.d., latest
No. 2½B, 3B, 4 Milwaukee, m.d.
No. 3V Toledo, s.p.d.
No. 3V Van Norman, m.d., latest
No. 5 Brown & Sharpe, cone
No. 5 Jackson, m.d.
No. 5 Reed-Prentice, m.d., latest
No. 6 Becker, cone
Cincinnati Hydromatic, m.d., 2 spindles

### SURFACE GRINDERS

No. 3 Abrasive, m.d.
No. 76 Van Norman Automatic Piston Turning and Grinding Machine, m.d.
Arter Model A-1-8" Rotary, m.d.
No. 11 Blanchard Rotary, m.d., latest
No. 16 Blanchard Rotary, m.d., 26" chuck
18x16x60" Thompson Hydraulic, m.d., late
No. 22—12" Heald Rotary, m.d.,
No. 25A—24" Heald Rotary, m.d., latest
No. 25A—16" Heald Rotary, m.d., latest
No. 33 Abrasive Vertical, m.d.
No. 260—16" Heald Rotary, belt
10x12x60" Norton Hydraulic Surface, m.d., latest
14" Pratt & Whitney Vertical, m.d.
22" Pratt & Whitney Vertical, m.d.
24x28x144" Thompson Hydraulic, m.d., latest
54" Bridgeport Knife, belt

### THREAD GRINDERS

No. 33 Excello Precision, m.d., latest
No. 39A Excello Internal Thread, m.d., latest

### TOOL & CUTTER GRINDERS

Cincinnati Monoset, m.d.
Sterling Tool & Cutter, m.d.
Gleason Cutter, m.d.
No. 2B Sellers Drill, m.d.
No. 12M Grand Rapids Tap, m.d.
No. 4T Sellers Tool, m.d., latest

### MANUFACTURING LATHES

No. 4 LeBlond Boring Lathe, 27' bed, 13" hole
No. 9, 12 LeBlond Multi-Cut, m.d.
31½x36", 31½x80", 4x60", 8x84" LoSwing, m.d.
8x132" Lo Swing, m.d., latest
9x12" Sundstrand Mfg., s.p.d.
11x18" LeBlond Rapid Production, m.d.
13"x24" LeBlond Rapid Production, Timken, latest
13"x24" Coulter Automatic Threading, m.d.
13x36" LeBlond Rapid Production, Timken, latest
13x48" Coulter Automatic Threading, m.d.
16"x6 LeBlond Rapid Production, m.d.
17"x6' LeBlond Automobile Mfg., cone
17"x8' LeBlond Rapid Production, m.d.
17"x8' LeBlond Automatic Mfg., m.d.
20"x8' LeBlond Mfg., m.d.
Niles Bement Pond Quartering Machine, m.d., new
Schauer Type NA 2B Speed Lathe, m.d.

### BROACHING MACHINES

No. 4 Oil Gear Hydraulic, m.d., 64" stroke
No. 4 LaPointe of Hudson, gear box
No. 75 H.P. LaPointe Horizontal Hydraulic, 150" stroke, 37½ tons cap.
Cincinnati Mill Broach, m.d., 10" spindle, new

### HORIZONTAL DRILLS

No. ½Bx30" Pratt & Whitney 2 spindle Deep Hole Reaming Machine, m.d.
No. ½Bx50" P. & W. Deep Hole Drill, m.d., latest
No. ½Bx50" Pratt & Whitney Gun Barrel Rifling Machine, m.d., latest
No. 1Bx50" Pratt & Whitney Deep Hole Drill, m.d., latest
No. 1 P. & W. 2 spindle Deep Hole Drill, m.d.
No. 1½x105" Pratt & Whitney 2 spindle Deep Hole Drill, m.d., latest
No. 1½Bx105" Pratt & Whitney 2 spindle Gun Barrel Rifling Machine, m.d.
No. 1½ P. & W. 2 spindle, m.d., older type
Pratt & Whitney Rifling Machine, belt
5 spindle Detroit Semi-Automatic Drill, belt
No. 6 Barnes Twin Spindle Honing Machine, m.d.
2 spindle No. 410 W.F. & John Barnes Deep Hole Drill, m.d.

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# Make BOTWINIK NEW HAVEN Your Machinery Headquarters

## Modern Machine Tools Ready to Ship
## Immense Stock.....

### DRILLS

Baush M.D. Multi 12 Spd. 53 M.T.
Avey & Allen 3, 4, 5, & 6 Spindles
Fox M.D. Type 138C Multi Spdl. Late
Cincinnati-Bickford 3', 4', 5' & 6' Radials
Niles-Bement & Pond 6' Radial
Barnes No. 2—4 Spd. M.D. Hydram Late
Pratt & Whitney Keller Type BL-2416
Semi-Auto. Duplicator
K. & T. No. 2HL, No. 4H Plain
Milw. No. 3B Univ. D.O.
Cin. Nos. 2 & 3 Vert.
Van Norman No. 3SP Plain
Van Norman Nos. 0, 10 & 11 Duplex
P. & W. 8", 10" & 12" Auto.
P. & W. 6"x80" M.D. Thread
Cinn. No. 3 M.D. Plain
Potter & Johnston 2M Horiz. Auto
Gorton No. 9J Vert. Late
B. & S. No. 21 Plain Auto.
Kempsmith No. 2G Plain Late
Kempsmith No. 4, Plain Max. Late

### GRINDERS

Norton 6"x10"x36" Surface
Norton 15"x17"x72" Surface
B. & S. Nos. 1, 2, 3, 4 Universal
Bryant Nos. 3B, 6 & 12 Internal
Cincinnati No. 2 & No. 3 Centerless
Cincinnati No. 3 Centerless Lapper
Blanchard No. 16—26" & 16A
Blanchard No. 16—30 Vert. Late
Heald No. 22—12", 16" Rotary Surface
Abrasive Nos. 33, 3 & 34 Surface
Heald Nos. 70A & 72A Internal
P. & W. 14" Vert. B. B., M.D.
Norton Type "C" 6"x18" M.D. Hyd. Cyl
Norton 10"x24" M.D. Plain Cyl.
Landis "H" 4"x18" Plain Late

### LATHES

Johnson 36"x36' B.G.L.C.G. Engine
Monarch 12"x30" CK (swings 18")
Hendey Plain 12", 14", 16", 18" Yoke Head
Hendey 12"x5' Y. H. Fact. M.D.
Hendey 24"x8' M.D. Q.C.G. Eng.
Hendey 12"x5' M.D. Geared Head
American 30"x16' G.H. M.D. Q.C.G. Eng

### MILLERS

K & T 2H D.O. M.D. Pl. Late
K & T 2H Vert. M.D. Sliding Hd. Late

### SHAPERS

Cincinnati 24" M.D. Crank Late
Hendey 32" M.D. Crank Late
Gould & Eberhardt 24" Crank
Gould & Eberhardt 16" M.D. Crank

### PRESSES

Verson 500 Ton M.D. Twin-Geared S.S.
Niagara 3612-C, Double Crank Double B.G. M.D.
Bliss No. 52 2¼" Stroke B.G. M.D. S.S.
Bliss No. 5½-42 M.D. S.S. double crank
Bliss No. 304 M.D. S.S. Single Crank
Bliss No. 703 M.D. Flat Edge Trimming
Bliss No. 21 O.B.I. Power

### SCREW MACHINES

B. & S. Nos. 00, 0, 2 Automatic
B. & S. Nos. 1 & 2 Hand
Gridley ⅞", 1¼", 1¾" & 2⅝" Model G
Cone 1¼", 3¼", 3½" & 4¾"—4 Spindle
Simmons No. 2 Micro-Speed
Foster No. 7 & 7B
W. & S. Nos. 1, 2, 2A, 3A Univ.

### BROACHES

3 ton American vertical
No. 1 Foote Burt duplex surface
9 ton American horiz. surface
Twin 10 Oilgear duplex
No. 3XA Oilgear
30 ton No. V48 American vertical
No. 3 Lapointe screw type

### RADIAL DRILLS

3' Morris
4' Hammond elbow arm
4' Cint. Bickford universal
4' American triple purpose
6' Dreses
6' Cincinnati Bickford
7' American triple purpose

### GEAR CUTTERS

Nos. 3, 12 & Type T Barber Colman
Nos. 8H, 12H & 16 HS Gould & Eberhardt
No. 130 Cleveland Rigidhobber
Nos. 1, 5A & 5AC Lees Bradner
No. 5M Adams Mfg. hobber
12" Reed Ring gear shaver

### GRINDERS

Model HRS Barber Colman hob & cutter
Nos. 1 & 2 Brown & Sharpe universal
6"x18", No. 10 B. & S. Elec. hydraulic
10"x18" & 14"x36" Landis hydraulic
10"x36" & 23"x36" Norton hydraulic
Nos. 10 & 18 Blanchard rotary surface
12" & 16" No. 22 Heald rotary surface
16" & 24" No. 25A Heald rotary surface
10x24 Norton hydraulic surface
12"x48" Thompson hydr. surface
14"x60" Mattison hydr. surface
53", No. 372 Gardner horiz. disc
No. 115 Gardner opposed disc
30", No. 230 Hanchett opposed disc
Nos. 72A3 & 72A5 Heald internal
No. 18A16 & 24-36 Bryant internal
10" Pratt & Whitney gear grinder
No. 2 Cincinnati centerless
Nos. 33 & 35 Excello thread
No. 2 Norton tool & cutter

### LATHES, TURRET

No. 2 FU Foster Fastermatic
24" & 42" Bullard vertical
Nos. 2, 3, 4, 1A & 3A Warner Swasey
Nos. 4 & 3AL Gisholt
Nos. 6, 2 Denver universal
Nos. 2G & 3 Morey
No. 601 DD Oster
Nos. 5 & 7 Bardons & Oliver

### MILLERS, MFG.

24" & 48" Cincinnati duplex
No. 3—36 Cincinnati Hydromatic duplex
No. 18-36 Kearney & Trecker duplex
Nos. 1-12, 1-18, 2-18 & 2-24 Cincinnati automatic
Nos. 3-24, 4-36, 4-38, 5-60, 56-72 & 56-90 Cincinnati Hydromatic
Nos. M18, M24 & 12-24 Kearney & Trecker
Nos. 1, 1M & 3 Kent Owens
30", 42" & 84" Ingersoll Rotary
No. 08 Cincinnati, horiz. vertical or rise & fall
Nos. 4, 40 & CT36 Lees Bradner thread
Types C & D Hall Planetary

### PRESSES

No. 2½ Toledo OBI
No. 6 Consolidated OBI
No. 23 Bliss OBI
Nos. PA4 & CA4 Ferracute horning
Nos. 1½ & 1½C Bliss cam drawing
42", No. 90E Toledo double crank
Nos. 304 & 75½ Bliss straight side
No. 56 Toledo straight side
350 ton Clearing No. F1350-42
600 ton Hamilton No. 2316½
700 ton No. 7C Ajax forging
75 ton Southwark hydraulic
300 ton French Oil hydraulic
500 ton Clearing hydraulic

**373 WELTON ST., NEW HAVEN 9, CONN.**
**EXPORT DEP'T: 44 G WHITEHALL ST., NEW YORK**

**Botwinik Brothers**
INCORPORATED

### PLANERS

48"x48"x12' Cincinnati Rapid Traverse, 4 heads
36"x36"x12' Woodward & Powell, 4 heads
32"x32"x10' Whitcomb, 2 heads
24"x24"x10' Whitcomb, 2 heads
*Older Type machines, in excellent condition*

**HAZARD BROWNELL**
350 Waterman St., Providence 6, R.I.
Dexter 8880

National Bent Shank Nut Tappers Battery of ⅝" to 1" Machines.
Waterbury-Farrel Fdry. ⅝" and 1" D.S. S.D. Cold Headers, also Thread Rollers.
Fisher 5" Bar, Floor Type Boring Mill. New in 1942.
Niles, Bement, Pond 60"x60"x24' table 4-Head Planer, Rev. D.C. M.D.
Bliss Presses in all sizes up to 1,000 ton capacity.
Wire Working Machinery.

**National Machinery Exchange**
128-138 Mott St., New York 13, N.Y.

**MILES MACHINERY CO.**
**SAGINAW, MICH.**

# LATEST TYPE NEARLY NEW MACHINES

### AUTOMATIC SCREW MACHINES

BROWN & SHARPE #2G High Speed, Latest Type
CLEVELAND 9/16" Single Spindle, Latest
CONOMATIC 6" 4 spindle, Latest Type
CONOMATIC 2¾", 6 spindle, Latest Type
GOSS & DeLEEUW 8" Automatic Chucker, 5 spindles

### BORING MILLS—HORIZONTAL

CINCINNATI-GILBERT 3½" Bar, Floor Type, Latest
DETRICK & HARVEY 4" bar, Floor Type
GIDDINGS & LEWIS #25, 2½" Bar, M.D.
GIDDINGS & LEWIS 25T, 2½" bar, Latest
HEALD 48A, 49 Single End Bore-Matics, Latest
LANDIS #35, 2½" Bar, Floor Type, M.D.
LUCAS #41, 3" Bar, Table Type, Latest Type
NILES BEMENT POND 3", 6" bar, floor type, M.D.
NILES BEMENT POND 8" floor type, M.D.
UNIVERSAL 2" bar, table type, high speed, latest

### BORING MILLS—Vertical

BETTS 120" 2 swivel heads, AC, M.D.
BULLARD 61 Maxi-Mill, 2 heads, Motor Drive
BULLARD 16" 6 spindle, Mult-au-matic, Type D Single Indexing, Latest Type
BULLARD 36" Vertical Turret "Spiral Drive" Latest
BULLARD 36" Vertical turret side hd., New Era M.D.
COLBURN 72" AC, M.D., 2 swivel heads, PRT
KING 62" 2 swivel heads, PRT, M.D.
NILES 100" 2 Swivel Heads, PRT, M.D.

### BROACHES

AMERICAN V-2, 6 ton Vertical, hydraulic, latest
CINCINNATI 1-36 Duplex Vert. Hyd., Latest
CINCINNATI 3-36 Duplex Vert. Hyd., Latest
La POINTE Model C.P.C. 5-36 Vert. Hyd., Latest

### GRINDERS—Misc.

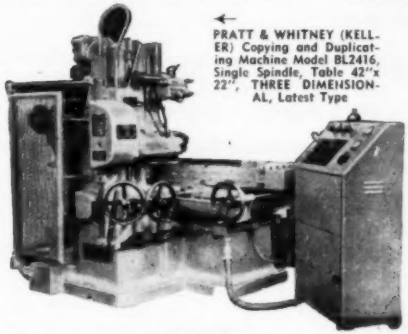
BRYANT #5, #16-16, #16-CP-16, #24, Internal Hydraulic, Latest Type
CINCINNATI #2 Centerless, "Filmatic", Latest
CINCINNATI Centerless Lapper, Model ED, Latest
CINCINNATI "Monoset" Tool & Cutter, Latest
COVEL #22 Universal Tool & Cutter, Latest type
EXCELLO #66C Carbide, Latest
FITCHBURG 14"x25" Spline, Hydraulic, Latest
GLEASON #12 Tool Sharpener, Latest Type
HEALD 75A, 72A3, 72A5, 74, 70A Internal, Latest
HEALD #72A3, 72A5 Internal "Gagmatic", Latest
JONES & LAMSON 6x15, 8x18, Auto. Thread, Latest
LANDIS #12 Centerless, Latest Type
PRATT & WHITNEY Contour, Latest
THOMPSON 8"x18" Auto., Round Broach, M.D.

### GRINDERS—Surface

BLANCHARD #11—16 chuck, Latest Type
BLANCHARD #16—24" chuck, Motor Drive
BROWN & SHARPE #5, 8"x24", Hyd., Latest
DO-ALL Model G-7, 9"x26", Hyd., Latest Type
GALLMEYER & LIVINGSTON #35, 8"x24", Latest
HEALD #22, 12" chuck, Rotary, latest type
HEALD 25A, 16" or 30" Chuck, Rotary, Hyd., Latest
NORTON 6"x18"—Hyd.—Latest Type
THOMPSON 12x12x24 Type B Hyd., Latest
THOMPSON 12x12x40 Type B Hyd., Latest

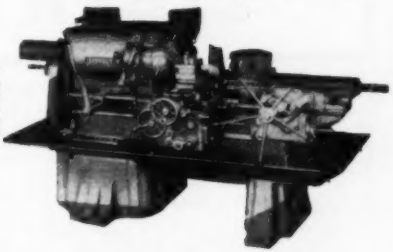
### LATHES—Engine and Mfg.

AMERICAN 36"x360" centers, 2 carriages, M.D.
BRIDGEFORD 36"x24' centers, 2 carriages, M.D.
JONES & LAMSON "FAY" 20"x27" Automatic, Latest
LEHMAN 16x20 hydratrol, Tiuken, latest type
LODGE & SHIPLEY 18"x72" centers, M.D.
LOSWING 4x60, 4x84, 8x60, 8x108, 5x54" centers, latest
MONARCH 22x456" centers Model CM, 3 car, Timken Latest Type
MONARCH 12x54" centers Timken, Latest Type



← PRATT & WHITNEY (KELLER) Copying and Duplicating Machine Model BL2416, Single Spindle, Table 42"x 22", THREE DIMENSIONAL, Latest Type

GISHOLT #3 Universal Ram Type Turret Lathe, Timken Bearing, for bar or chucking work, Swing over bed 18½", bar capacity—round 1½", Latest Type →



### GEAR CUTTING EQUIPMENT

BARBER COLMAN #12 Hobber; motor drive
BARBER COLMAN Type S Hobber, Latest Type
BROWN & SHARPE 6-72 Gear Cutter, M.D.
FELLOWS Model Z Gear Shaper, High Speed, Latest
FELLOWS 61, 7, 7A, 72, 75, 77, High Speed Gear Shapers, latest type
FELLOWS Type 6Z2 Gear Shaper, High Speed, Latest
FELLOWS #13 LS Lapping, Latest Type
GLEASON 3", 12" Straight Bevel Generator, latest
GOULD & EBERHARDT 12H, 12HS Hobber, Latest
GOULD & EBERHARDT #36H Hobber, M.D.
GOULD & EBERHARDT 96H with Differential, M.D.
PRATT & WHITNEY 10" Grinder, hyd., latest

### GRINDERS—Cyl.—Plain & Univ.

BROWN & SHARPE #1, 2 Universal, Latest
BROWN & SHARPE #5 Plain, 3x12, Latest Type
BROWN & SHARPE #20, 10x18 plain, latest type
CINCINNATI 16"x36", Plain, "Filmatic" Latest
LANDIS 4"x12", 4"x18" Type H, Plain, Hyd., Latest
LANDIS 6x18 Type C, Plain, hydraulic, latest
NORTON 6"x18", 6"x30", Type C Plain, Hyd., Latest
NORTON 10x72 centers Plain Type C Mech., Latest
NORTON 14x36" centers Plain Type C Hyd., Latest
MONARCH 18"x72" Centers, Timken, Latest
MONARCH 10x20" centers, Model EE Timken, Latest
MONARCH 12x30" centers, Timken, Latest Type
MONARCH 24"x54" centers, geared, Motor Drive
NILES 42"x60", double head, M.D.
NILES 20x110 centers Standard Driving Wheel, M.D.
NILES 30x36' Boring, Timken, Latest Type
PRATT & WHITNEY 10x30" centers, Timken, Latest
PRATT & WHITNEY 10x20" centers, Bench, Latest
PRATT & WHITNEY 16"x60' centers, geared, M.D.
PUTNAM 42"x25' centers, geared, Motor Drive
REED PRENTICE 10x24" centers, geared head, M.D.
REED PRENTICE 16x48" centers, Geared Head, M.D.
SCHUMACHER & BOYE 24"x158" centers, geared, M.D.
SPRINGFIELD 16"x30" centers, Timken, Latest Type
SPRINGFIELD 14x42" centers Geared Head, M.D.
WARD HAGGAS & SMITH 18x36"x10' bed, Gap

### LATHES—Turret

BARDONS & OLIVER #5, #7 Timken, latest
CINCINNATI ACME No. 1, Latest Type
FOSTER 4FU, Fastermatic, Timken, Latest
GISHOLT #3, 4, Univ., Timken, Latest
GISHOLT #1L, #2L, Universal, Timken, Latest Type
JONES & LAMSON #3, #5, Univ., Latest
POTTER & JOHNSON 5D, 5D2E, Timken, Latest
MOREY No. 2G, No. 3, No. 4 Timken, latest
WARNER & SWASEY 2A, Univ., Bar & Chuck, with or without "PRE-SELECTOR", Latest
WARNER & SWASEY #5, Univ., Timken Bearing
WARNER & SWASEY #1A, Univ., Latest Type
WARNER & SWASEY #3 Univ., Timken, Latest

### MILLING MACHINES—Mfg.

INGERSOLL 42x36x12' Planer type, Adjustable rail, 4 heads, AC, M.D.
INGERSOLL 32x30x12' Planer Type Slab, AC, M.D.
INGERSOLL 32x24x16' Planer Type 2 heads, AC, M.D.
SUNDSTRAND Model 3A Duplex, Timken, Latest Type
TAYLOR & FENN M-80 Duplex, Spline, Latest Type

### MILLING MACHINES—Plain

BRUGGS Type A Hyd., 12" and 18" feed, Latest Type
BROWN & SHARPE #12, 24" feed, Timken, Latest
BROWN & SHARPE 3B, Timken, Latest
BROWN & SHARPE No. 2 Light Type, Timken, Latest
CINCINNATI #4 Timken Bearing, M.D.
CINCINNATI #3, 4, 5, Motor Drive
CINCINNATI 4-36 Hydromatic, latest type
CINCINNATI 0-8 Auto. rise and fall, Timken, Latest
KEARNEY & TRECKER #3, 4 heavy, Timken, latest
KEARNEY & TRECKER 12H, simplex, latest
KEARNEY & TRECKER 2H, Timken, Latest Type
KEMPSMITH #3G, Timken, Latest Type
KEMPSMITH #4 Maxi-Mill, Timken, latest

### MILLING MACHINES—Vertical

CINCINNATI 0-6 Timken Bearing, Latest Type
CINCINNATI #2, 3, 4, Dial Type, Timken, latest type
GORTON 8½D, 9J, Super-Speed, Latest
KEARNEY & TRECKER #3H, Timken, Latest
REED PRENTICE 3VG with or without Hydraulic Duplicator, Timken Bearing, latest type

### MILLING MACHINES—Thread

HANSON & WHITNEY 4"x9" centers, Latest Type
PRATT & WHITNEY 6x60" Type C, Latest Type
MOREY 12x30, 12x60, Latest Type

### MILLING MACHINES—Universal

AMES 2½"x19" Table, Latest Type
BROWN & SHARPE #4A; Motor Drive
HARDINGE Model UM, Timken, Latest
KEARNEY & TRECKER #2 Heavy, Timken, M.D.
KEARNEY & TRECKER 2H, 3H, Timken, Latest
KEMPSMITH #4 Maxi-miller, Timken, Latest
VAN NORMAN #3, Duplex, M.D.
VAN NORMAN #12, #36, Timken, latest type

### PLANERS

DETRICK & HARVEY 48x48x16', 4 heads, Hyd.
GRAY 36x36x8', 2 heads, maximum duty, DC, M.D.
NILES BEMENT POND 48x48x16', 3 heads, AC, M.D.
NILES 54x54x18' 4 Heads, Box Table, DC, M.D.
SELLERS 30' Plate Edge, Motor Drive
WOODWARD & POWELL 54x54x20', 4 heads, DC, M.D

### PRESSES

BIRDSBORO 325 ton, vert. hyd., Latest Type
CHAMBERSBURG 50 ton vert. hydro-pneumatic
CLEARING Type DS 1125-32 dbl., action 125 ton.
CLEARING Type H-50-36-35 ton Vert. Hyd., Latest
FERRACUTE #DG-55, 75 ton drawing, Latest Type
HPM 37-ton Vertical Hydraulic, Latest
NILES 600 Ton Horiz. Wheel Press, M.D.

### MISCELLANEOUS

AJAX 1½", 3½", Bolt Heading, Upsetting and Forging
BARNES #172, 306H, 307 Vertical Hone, Latest Type
CAMPBELL #401 Abrasive Saw, Latest Type
CLEVELAND 12"x16" Cutter Reliever, Motor Drive
FOSDICK #42 Jig Borer, Latest
GROB #08-20 Band Saw & Filer, Latest
PELLOW #2 Nut Slotter, Latest Type
PRATT & WHITNEY "Keller" Type G, Type BL3416 —Latest Type
PRATT & WHITNEY ⅛Ba50 2 spindle Rifler, Latest

***Available for Prompt Shipment*** ***Most Built After 1941***

***(Partial List) Over 2,000 Machine Tools In Stock. Your Inquiries Are Invited . . . Prompt Service Is Assured***


**MOREY MACHINERY CO., INC.**
**406 BROOME ST., NEW YORK 13, N. Y.**
**TELEPHONE: CANAL 6-5360**
**CABLE ADDRESS: WOODWORK, N. Y.**

# LATE MACHINES, HEAT TREATING & MATERIAL HANDLING EQUIPMENT

## MACHINE TOOLS

Auto Screw Machine—Cleveland 2½" A, serial 40458-243
Turret Lathes—Morey 2G Oster
Planers—
24" Liberty Double Housing—8' table
30" Liberty Openside 12' table
48" Liberty Double Housing Die Block—14' table
84" Liberty Double Housing—40' table
108" Liberty Convertible—28' table
Lo Swing lathe 4"x60" hardened ways

## HEAT TREATING EQUIPMENT

6 Furnace atmosphere gas generators GE 500CFH . . . $1500 each
1 Furnace atmosphere gas generator Westinghouse Endo gas . . . $1700
5 Leeds & Northup indicating recording and controlling instruments, 0-1200° . . . $150 each
5 Wheelco Limitrols . . . $100 each
5 Blowers with Leeds & Northup valve control . . . $50 each

## MELTING FURNACES

3 Campbell Hausfeld aluminum furnaces, oil or gas fuel . . . $175 each

## WELDING & CUTTING EQUIPMENT

2 GE transformer welders, 200 amp. . . . $150 each
1 Westinghouse Flexarc motor generator welder, 200 amp. . . . $187
1 GE Atomic Hydrogen Arc welder for Ni, Cr, stainless, etc. . . . $450
1 Federal Butt welder . . . $600
1 Taylor-Winfield spot welder . . . $250
1 Swift cable cutter and welder . . . $600
2 Union melt automatic welders complete . . . $1750 each
1 Oxy-acet. cutting machine . . . $75

## PORTABLE POWER TOOLS

25 Nut setters 3/16" high frequency . . . $50 each
2 Nut setters 5/16" pneumatic . . . $90 each
5 Nut setters ⅜" right angle pneumatic . . . $35 each

## MATERIAL HANDLING EQUIPMENT

1 Y & T non-elev. platform truck, 4000# cap. . . . $1000
1 Y & T elect. tractor less battery . . . $400
1 Platform truck, 1000# cap. less battery . . . $100
1 Baker 4000# cap. fork lift, Ready-power unit . . . $3000
9 4000# hand pallet trucks . . . $180-$225 each
4 4000# and 5000# hand lift trucks . . . $130-$175 each
22 Platform trucks, 4-wheel . . . $20-$25 each
1 1000# Kron scale . . . $200
29 Jib cranes 250# cap. self-supporting . . . $35 each

## DUST COLLECTORS, AIR FILTERS & SPRAY BOOTHS

7 Rotoclones, type D, size 14, complete with hoppers and after-cleaners . . . $625 each
92 Precipitron Oil Mist units, Westinghouse for removing oil mist from atmosphere surrounding high speed machining or grinding operations
3 Spray booths
33 Blowers
8 Wing DC blowers, 35,000 CFM

## OIL EXTRACTOR

1 30" American chip wringer

**Phone or wire MR. WARNER**

# LIBERTY PLANERS, INC.

**HAMILTON, OHIO**

## UNUSUAL VALUES

**Milling Machines**—No. 1, Universal, No. 1 American (new) plain, No. 1 Vertical.

**Drills**—Large selection, single and multiple spindles also bench types, many of them new.

**Gear Cutters**—Brown & Sharpe No. 3—26" Gould & Eberhardt 42".

**Grinders**—Cylindrical B & S No. 11, Planer type 16"x36", Surface 18"x62", also new (small) Universal bench and floor type. All with coolant, motorized.

**Lathes**—14"x8', 8', 10—16"x6', 8', 10'—18"x6', 8', 10'—20"x16'—all cone drive, several motorized also (new) 18"x8' and 10' geared head, motorized
Large stock 19" and 18" bench and floor type.

**Planers**—Single head 24"x6', 24"x8', 36"x8'.

**Shapers**—16", 20", 24", B.G. crank.

**Turret Lathes**—J & L 2"x24"—3"x36" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".

**SPECIAL**—New totally enclosed dust proof, fan cooled, ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 3¼" from center of shaft to flatted top (1 h.p. to 15 h.p.) 3 or 3 phase, 3600 r.p.m.

**WOOD WORKING MACHINERY**—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

**Drill**—Foote-Burt No. 25 24" HI Duty 3" capacity in steel. Motor attached.

**PATTERN MAKING MACHINERY**—42"x10' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

**THE OSBORNE & SEXTON MACHINERY CO.**

**P. O. Box 88, Columbus 16, Ohio**

## BENNETT SPECIALS

#2L Gisholt Univ., Chuck, 1942 (2)
36" Bullard Mill, Spiral Dr., 4 Jaw
4" bar Universal Table Type Mill, 60" spin. to table, 96" spin. to outer support, '42.
3½" & 4" Landis Floor Type Mills
3" bar Yoder, Table Type Hor. Mill, 30" spin. to tble., 72" spin. to outer support
48"x20' centers N.B.P. Lathe, Grd. Hd.
36"x32" bed Niles Lathe, 2 carr., T.A.
7' Carlton 17" col. Radial, 1943
Nos. 5, 4, 3 & 2 W. & S. Turrets, Late
No. 4 Gisholt Univ. Turret Lathe, 1942
2⅝" Acme Gridley RB8, Automatic, 8 spin.
1⅛" Conomatic, 8 spin. (4)
#4H—12" Libby Slid. Bed Gap (5)
36"x36"x12' Cinci. Hypro Planer, 4 hds., Var. Voltage, 1943
24"x24"x16' Ingersoll Planer Type Miller, 4 hds., 20 H.P. AC, M.D.
48" N.B.P. Slotter, Grd., Late
15'x¾" Wickes Rolls, M.D.
42" & 36" King, Side Hd., (2) '43
2½" bar #25T G & L Table, '43
16"/18¼"x54" cc Reed Pr., 1942
3' Fosdick 11" col., late, 1943
#65 New Britain Gridley, 6 spin., '43
#36 Van Norman Miller, 1944
Index Miller, Univ., late
1⅝" New Britain Gridley, 6 spin., late (2)
24"x24"x68" Rockford Planer-Shaper
ML16 Duall Saw, late

**BENNETT MACHINERY CO.**

**30 Church St., New York 7, N. Y.**

## AUTOMATICS

#9G B & S, late type
1½" & 1⅝" 8 Spdl. Cone, late
9/16", 1", 1¼", 1⅝", 2", 2¼", 2⅝" Acme Gridleys, late
2¼ & 2⅝" Cone 6 Spdl., late
12" and 18" 8 Spdl. Bullard Multiautomatics, late

## PRESSES

2800 ton Bliss Hydr., 3 cyl. type, 12" str., 50½" sht. ht., dia. bed 119"
60 ton Dbl. Crank, 5" stroke, 48x24 bed, late model Waterbury Farrel
90 ton Dbl. Crank, 8" stroke, 48x18 bed, late model Bliss
35 ton 4, 5, 6" stroke, latest type, w/all accessories, Bliss $850.00 ea.
70-85 ton 4" stroke 21 x 27 bed, 110 strokes per min., Bliss, latest type
90-125 ton 4½" or 5" stroke, 60, 80, 110 (optional) strokes per min., late type
Inclinable, New, 20 to 70 ton, immediate delivery
375 ton Elmes, 12" stroke, 84x54 bed, late type
350 ton Elmes, 20" stroke, 36x45 bed, late type
250 & 750 Baldwin, 144x48 bed, 40" stroke
#385 Bliss, 12" stroke, late

## TURRET LATHES

#3 & #5 Warner & Swasey, late type, lots of tooling
#4FU Fastermatic, 4" cap., late type
#3H8 Libby Sliding Bed Gap, 8¼" cap., late type

**PAUL'S MACHINERY COMPANY**

MONA MEMBER

**6111 Vermont Avenue**
**Detroit 8, Michigan**
TYLER 7-6300

## FOR SALE

**DEFIANCE #5A HORIZONTAL TABLE TYPE BORING MILL**

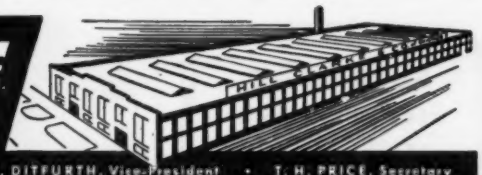
3¼" Bar — Serial #867-38
With Turchan Follower
Excellent Mechanical Condition
PRICE . . . . . $9,000.00

**WINSTON MACHINERY CO., INC.**
517 So. Delaware St., Indianapolis 4, Ind.

2—Lodge & Shipley Duomatic lathes
2—Potter & Johnston #5 DE Chucking machines
1—D. E. Whiton #16 gear cutter
1—Monarch Lathe, 32 x 48"
1—3 spindle Gould & Eberhardt spur gear and bevel rougher
1—Nesld double spindle Baromatic

**SIER-BATH GEAR & PUMP CO., INC.**
9252 Hudson Boulevard, North Bergen, N. J.

# HILL-CLARKE MACHINERY COMPANY



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**FOR YOUR PROTECTION ONLY HILL-CLARKE OFFERS YOU THIS 5 WAY GUARANTEE**

1. A responsible organization—82 years experience
2. Modern machines — no worn out equipment
3. Every machine remanufactured or carefully inspected by experienced craftsmen.
4. You can see your machine tested under power.
5. Hill-Clarke's unconditional money-back guarantee.

## AUTOMATICS

No. 2 Brown and Sharpe
1½" Greenlee, 6 Spdls. (1941)
No. 61 New Britain 6 Spdls. 1½" (1942)
No. 6 Brown & Sharpe
No. 49 New Britain, 4 Spdls.

## DRILLS

No. 150 Baker
No. 314A Baker
No. D6 Colburn No. 6 Morse Taper
No. 1LMS—20"—5 Spdl. Leland-Gifford
No. 2LMS—26"—1 Spdl. Leland-Gifford
No. 2LMS—14"—3 Spdl. Leland-Gifford
No. 2LMS—28"—4 Spdl. Leland-Gifford
No. 2LMS—26"—6 Spdl. Leland-Gifford
No. 3B—24"—6 Spdl. Edlund (1942)
No. 4BL Natco 36 Spdls.
6'-17" Col. Feedick Radial
7'-15" Col. American Full Universal

## GEAR MACHINES

No. 61-A Fellows Gear Shaper
No. 7125 Fellows (1943)
No. 712 Fellows Auto Indexing (1943)
No. 72 Fellows Gear Shaper
No. 18H Gould & Eberhardt
No. 6 Gleason Gear Tester
12" Gleason Bevel Gear Cutter
72" Cincinnati Gear Cutter

## HORIZONTAL BORING MILLS

No. 31 Lucas, 3" bar
No. 48-B Heald Bore-Matic

## GRINDERS

4"x12" Landis, Model H (1942)
4"x18" Landis Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"x18" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x48" Norton Type C Plain (1943)
Norton Motorized Grinders
6"x18" —— to —— 24"x240"
12"x36" Landis Type LCH Universal (1945)

---

No. 5—8"x24" Covel Hydr. Surf. (1941)
No. 25A—24" Heald Rotary Surface (1943)
No. 36-A Hanchett Rotary Surface

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72A-3 Heald Internal Grinder (1942)
72A-5 Heald Internal Grinder (1942)
74 Heald Internal Gdr. (1942)
No. 5 Bryant Internal Grinder (1942)
No. 16-18 Bryant Internal Gdr. (1942)
No. 18-36 Bryant Internal Grinder (1942)
No. 24—26 Bryant Internal Grinder (1941)

## LATHES

14"x6' Hendey Yoke Head
15"x5' Sebastian, Grd. Head
16"x54" centers LeBlond (1941)
16"x60" centers Pratt & Whitney, Model B
18"x6' American, Grd. Head
19"-36" gap x 10' LeBlond
36"x30' Lodge & Shipley
36"—48"x16' Lehman Hydratrol (1945)
48"x20' centers Simmons (1942)
50"x17' centers LeBlond (1942)

## LATHES (Production)

8"x15" Sundstrand, Model D (1943)
10"x16" Sundstrand
10"x22" Sundstrand, Model AA (1943)
16"x33" Fay Automatic (1942)
20"x25" Fay Automatics (1942)
No. 3A Lodge & Shipley Duomatic

## MILLING MACHINES

No. 4 Cincinnati Plain (1943)
No. 0B Cincinnati Vert. (1942)
No. 2 H Milwaukee Vertical
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cinn. Mig. (1940)
No. 2—18" Sundstrand-Electromil (1942)
No. M-24 Milwaukee Simplex (1943)
38"x40"x10' Fitchburg Duplex Miller (1943)
No. 4-48 Cinn. Hyd. Tracer (1942)
No. 34-48 Cincinnati Hyd. Duplex
No. 45-48 Cinn. Hyd. Plain Tracer (1942)
4"x8" Hanson-Whitney Univ. Thrd. Miller
4½"x12" Pratt & Whitney, Model C
6"x36" Lees-Bradner—Model HT (1943)
6"x48" Pratt & Whitney Thrd. Miller
8"x80" Pratt & Whitney Thread
6"x132" Pratt & Whitney Thread Miller
8"x168" Pratt & Whitney Thread
10"x48" Hanson-Whitney Thread
24"x24"x12' Ingersoll Adj. Rail
36"x36"x16' Ingersoll Slab Miller
No. 10 Ingersoll 72"x8' Traveling Col. Face Millers (1942)

## MISCELLANEOUS

18" Dill Slotter
Model H-7 Micromatic Hydro Honer
Model H-2 Micromatic Hydro Honer
Model 200 Micromatic Hydro Honer
8-M Wells Band Saw
No. 20 Bliss O.B.I. Press
No. 2 V & O open back press
Baush Radial Tapper (1942)

## PLANERS

36"x36"x12' Cincinnati
36"x36"x18' Gray, 4 Heads
48"x36"x14' Gray
48"x48"x12' Cincinnati, 4 Heads

## TURRET LATHES

No. 3 Jones & Lamson Bar Feed
No. 4B Libby, Bar Feed
No. 5 Warner & Swaseys (1942)
No. 5 Bardons & Olivers (1942)
No. 5 Midland, Bar Feed
No. 2-A Warner & Swasey
No. 1-H Libby, 6¼ Hole in Spindle (1937)
No. 1-H Libby, Extras Long Bed (1942)
18" Libby, 3½" Hole in Spindle
No. 4A Warner & Swasey, 7½" Hole in Spindle
No. H-5 Libby

## VERTICAL BORING MILLS

36" Rogers, side hd. (1942)
42" Bullard New Era
42" Colburn
60" Colburn
72" Niles Extra Heavy
84" Betts

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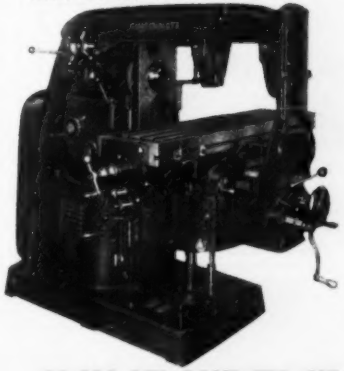

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1—Bridgeford 38"x56', M.D.; mtrd. Apron. 48' Cents.
1—Niles Bement Pond 48"x24' G.H. Eng. Lathe. 15' Cents.
1—American 30"x24' Medium Pattern. G.H. 18' Cents.

### MILLERS (Late Type)

Van Norman #2BU Univ.
Cin. 3B, motor-in-base, Univ.
B.&S. #2 Light Type PI.
B.&S. #3A, motor-in-base Univ.

### SHAPERS

Gould & Eberhardt 16", 20", and 24" M.D. Crank Shaper
Hendey 32" M.D. Crank Shaper (timk. bearing)
Hendey 12" M.D. Univ., late type
Cin. 18" Univ. M.D., late type

### TURRET LATHES (late type)

Jones & Lamson #5; bar feed, spdle 3" hole
W. & S. #3; spdle 2" hole, bar feed
B. & O. #3 spdle 3" hole, bar feed
Gishelt #5 Univ. pre-selector hd. Chucking Equip. 2½" rd. collet eqs.

### GRINDERS (late type)

Mattison 14"x24"x60" Hyd. Surf.
Blanchard #11, 10" chuck
B. & S. #2 14"x30" Univ. with atchmts.
B. & S. #13, 8"x24" Univ. & Tool

### BORING MILLS

Univ. #4 Tri-way, 4½" Bar
Univ. 4" bar Tri-way
Yoder 3A, 3" bar
Bullard 24", 36", 42" Spiral Drive

### SCREW MACHINES (late type)

2—Nat. Acme 9-10", Mod. RA 6-spdle
Cono. 1⅛", 8 spdle
B. & S. 00, and 2B

### PLANERS

Cin. 78"x56"x22', 4-hds.
Cin. 60"x48"x25' Hypro, 4 hds.
Liberty 72"x72"x20', 4-hds. (1942 machine)
Putnam 84"x84"x40'; 4-hds, rev. M.D.

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No. 4 Cincinnati Universal Mill, Timken Bearing, Rectangular Overarm, PRT

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Boring Mill, 60" Vert. Gisholt, 2-heads
Comparator, #20 Doall. (1945)
Drill, #23—38" Foote-Burt. (1942)
Drill, 5-spdl. Allen, type 2-KH, 5 motors 3/60
Grinder, #2 Cincinnati Tool & Cutter
Grinder, #2 Brown & Sharpe, Surface
Grinder, #14 Pratt & Whitney, B.D.
Hack Saw, 15"x15" Racine, AC. Motor
Lathes, 14"x8' & 16"x8' Monarch
Miller, #12 Brown & Sharpe Mfg. type. (1942)
Miller, Univ. #2B, Van Norman, ram type
MOTORS: 500 Gen. Elec. Wghse & F-M., 1 to 20 HP
Press, Zeh & Hahnemann, SS., 80-tons
Wire Forming Mach., 4-Slide, Nilson S-4

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BORING MILL, Hor. #0 G & L, 3" bar.
BORING MILL, Vert. 14' Niles 2 Hds., M.D.
BORING MILL, 42" King, 2 Hds., M.D.
BORING MILL, 72" Bullard, 2 hds., M.D.
BRAKE, Press, 36 Ft. x ¾", 60" thrt., M.D.
BROACH, XA Oilgear, Hor., 60" Str.
DRILL, Radial 3' & 5' Cincinnati-Bickford.
DRILL, Radial 6' American, Mtr. on Arm.
GEAR HOBBERS, 12-M Gould & Eberhardt.
GRINDER, Broach, "E" Thompson, 6x48" Hyd.
GRINDER, Int., No. 72-A-S Heald, Hydraulic.
GRINDERS, Surf. Nos. 3 & 5 Abrasives.
GRINDER, Surf. Heald.
GRINDER, T & C, No. 3 Ohio
HAMMER, Pneumatic, Nos. 4-B & 6-B Nazel.
HAMMER, St. Forging, 6000 p. Chambersburg.
LATHE, 14"x6' Hendey, Tie-Bar, T.A., M.D.
LATHE, 14"x6' Hendey, Grd. Head, T.A.
LATHE, 14"x6' L & S, 12-Speed Grd. Hd.
LATHE, 22"x10' L & S, Q.C.G., T.A.
LATHE, 42"x8' c-c, L & S, q.c.g.
MILLERS, Pl. No. 4, & 5 Cincinnati.
MILLER, Plain No. 4B K & T, Vert. Att.
MILLER, Thread, No. 40 Lees-Bradner.
MILLER, Univ. No. 2A B & S, S.P.D.
MILLER, Univ., No. 4 Cincinnati
PRESS, No. 58½, Toledo, 1200 Ton, 14" Stroke
PRESS, S.S., 250 Ton Chambersburg, Hyd.
SHAPERS, 24" and 32", M.D.
SHAPER PLANERS, Openside, 26" Fayrchar.
SHEARS, 12" x 16 ga., 11' x 1½", 13'x¼"
UPSETTERS, 4" National—2" Acme

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G & E 24" Cin. 32" Shapers
Cleveland O.S. Planer 36"x8', 2 hds.
Abrasive No. 34 M.D. Vert. Surf Grinder
Cincinnati D. H. Planer 36"x36"x10', 2 hds.
Monarch 20" grd. hd., M.D. Lathe 16 sp. Speeds Model "M"
Bullard Vert. Turret Lathes, 24" & 36" S. Head
Defiance 3" Horiz. Boring Mill & Univ. No. 3-A
L & S 18x12' & 20'x10', 20'x8' Grd. Hd., M.D.
& 28"x12' Lathes Monarch Model "C"
American 24x12 grd. hd. lathe, m.d. q.c.g.
American 4-ton vert. Hydr. Broach
Blanchard Vert. Surf. Grinder, 26 rd. chuck
Cincinnati No. 2 Centerless Grinder
Colburn 60" & 72" Vert. Boring Mills
Cincinnati 1-M grd. hd., Univ. tool room Miller.
Cincinnati No. 5 H.P. grd. hd, S.P.D. Pl, Miller.
W. & S. No. 2A grd. hd, Univ. Turret Lathe, S.P.D.
Foster No. 2F Ostermatic grd. hd. Turret Lathe, M.D.

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Libby 28" Turret Lathe, 4½" Hollow Spindle
#33 ExCello Ext. Thread Grinders
Lees Bradner CT 36" Thread Millers
W.S. Bowling Contour Roll Grinder
Oesrud Router Model A-4-RR 84"
Moline 3 sp—Model 7D—Cylinder Borer
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# MODERN
## *used and rebuilt*
# MACHINE TOOLS

### AUTOMATICS
Bullard Mult-Au-Matic, 6 spdl. Model D. 1941.
6" Goss & DeLeeuw Chucker, 8 spdl. 1943.
9/16" RA-6 Gridley. 1943.
9/16" RA-6 Acme Gridley Chucker. 1942.
No. 60 New Britain, 6 spindle. 1942.
No. 1½B Cleveland. Late.
Model 3-8 Ceco. Late.

### BORING MACHINES
3" Yoder Boring Mill. 1942.
No. 49 Heald "Bore-Matic". 1942.
No. 47A Heald "Bore-Matic". 1942.
No. 2112A Excello. 1943.

### BROACHES
No. CPC 6-30 LaPointe Vert. 1941.
6 Ton American Vertical, Late.

### DRILLS, HEAVY DUTY
No. H3 Barnes Vert. Hydram. 1942.
25" Fosdick Economax. 1941.
24" Sibley Sliding Head. 1942.
No. 3 Bausch Multiple Spindle.
Fox Multiple Spindle. 1944.
Barnes 2 Spindle Deep Hole. 1943.
No. ¼ B P & W Deep Hole. Late.
No. ½ B P & W Reamer. Late.
No. ½ B P & W Hyd. Rifler. Late.

### DRILLS, RADIAL
6' 17" Carlton. 1942.
3' 9" Dreses. Late.
20" Pfiffner Drillmaster. 1942.

### DRILLS, SENSITIVE
20" Walker Turner 6 Spindle. 1942.
No. KH2 Allen, 6 Spindle. 1943.
16" Atlas, 4 Spindle. 1942.
15" Atlas, 4 Spindle. 1942.
14" Delta. 4 Spindle. 1942.
No. 2 Motor Avey, 4 Spindle. 1942.
No. 2 MS Allen, 1 to 3 Spindle. 1942.
No. 2 Motor-Avey, 3 Spindle. 1942.
No. 2B-8 Edlund, single spindle. 1942.
No. 2 Hamilton-Muehlmat. 1943.
Leland-Gifford, Single Spindle. 1942.

### GEAR EQUIPMENT
3" Gleason Bevel Gear Gen. 1942.
No. 715 Fellows Gear Shaper. Late.
No. LS Fellows Gear Lapper. Late.
No. 6 Gleason Tester. Late.
No. 12 Gleason Tool Sharpener. 1942.
Model GCL-3 Red Ring Gear Shaver. 1942.
No. 860B Michigan Gear Shaver. Late.
15" Red Ring Gear Lapper. 1942.
Red Ring Universal Gear Checker. Late.
Type S Barber-Colman Hobber. 1942.
No. 140 Cleveland Hobber. 1942.
Vineo Spline & Gear Grinder. 1942.
No. 7125A Fellows Gear Shaper. 1943.

### GRINDERS, CYLINDRICAL
16"x36" Cincinnati Plain. 1942.
14"x36" Norton Type C Universal. 1943.
12"x48" Cincinnati Universal. 1943.
10"x24" Landis Type C Universal. 1942.
10"x18" Norton Type C Plain. 1942.
6"x30" Cincinnati Plain. 1943.
6"x24" Norton Plain. 1936.
6"x18" Landis Type C Plain. 1941.
6"x18" Norton Type C. 1942.
4"x12" Landis Type H Plain. 1942.
No. 2 Brown & Sharpe Universal. Late
No. 5 Brown & Sharpe Plain. Late.
No. 2 & 3 Cincinnati Centerless. 1942.

### GRINDERS, INTERNAL
No. 81 Heald "Sizematic". Late.
No. 74 Heald Extended Bridge. 1941.
No. 75A Heald, two motor. 1943.

**MODEL SRV 25-66 LAPOINTE Vertical Variable Speed Hydraulic Surface Broaching Machine, maximum capacity 40 tons, stroke 66". Latest model.**

No. 72A3 Heald Plain. 1942.
No. 72A5 Heald Plain. 1944.
No. 16A22 Bryant Internal. Late.
No. 5 Bryant Internal. Late.
No. 104 Rivett. 1942.

### GRINDERS, SURFACE
16"x16"x48" Thompson, Type C. 1943.
14"x36" Pratt & Whitney Vertical. 1942.
6"x18" Robot. 1942.
72" Rogers Knife Grinder. Late.
No. 2B Reid. 1944.
No. 25A Heald Rotary. 1942.
No. 22 Heald Rotary. 1943.
6" Taft Pierce Rotary. Late.
A-18 Arter Rotary. 1942.

### GRINDERS, TOOL & CUTTER
No. 2 Cincinnati Univ. 1941.
No. 13 Brown & Sharpe Univ.
No. 91A Covel Universal. 1942.
No. 22 Covel Universal. 1942.
No. 4T Sellers Carbide Tool. 1942.
No. 6G Sellers Drill Grinder. 1942.
Barber-Colman Combination. 1943.
No. 44, 48 & 49 Excello. 1942.
Milwaukee Face Mill. 1942.
No. P5 Bura Way Carbide Tool. 1942.

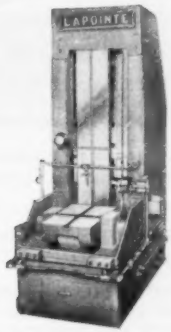
### LATHES, ENGINE
18"x54" Lodge & Shipley. 1943.
18"x48" Bradford. 1942.
14"x30" American "Pacemaker". 1944.
16"x8' South Bend c.d. 1944.
14"x54" Reed Prentice. 1942.
14"x30" Lodge & Shipley. 1943.
14"x6' Hendey.

### LATHES, PRODUCTION
Model 10 Sundstrand. 1942.
Model 8 Sundstrand. 1942.
14"x42" Monarch "Magna-Matic." 1941.
12"x18" Lipe "Carbo". Latest.
9"x20" Lipe. 1942.
8"x36" Lo-Swing Semi-Auto. 1942.
8"x21" Fay Automatic. 1942.
Model IMP & R Lo-Swing. 1942.

### LATHES, TURRET
No. 2A Warner & Swasey.
No. 1A Warner & Swasey. 1944.
No. 9A Jones & Lamson. 1942.
No. 1 Acme Universal. 1941.
8⅛"x24" Acme. 1943.
No. 3L Gisholt. Late.
No. 2L Gisholt. 1943.
No. 5 Warner & Swasey. 1941.
No. 4 Warner & Swasey. 1941.
No. 3 Warner & Swasey. 1943.
No. 2 Warner & Swasey. 1941.
No. 2, 5 & 7 Bardons & Oliver. 1941.
No. 3 & 4 Gisholt. 1943.
No. 4 Midland. Late.

### MILLING MACHINES, PLAIN
No. 3B Brown & Sharpe. 1941.
No. 2H Milwaukee. Late.
No. 2HL Milwaukee. 1942.
No. 2M Cincinnati.
No. 2B Brown & Sharpe.
No. 3 Van Norman. 1942.
Van Norman Hand Mill. 1942.

### MILLING MACHINES, PRODUCTION
No. BL2420 P & W "Keller", 3 spindle. 1942.
No. BL2416 P & W "Keller", single spindle. 1943.




No. BG "Keller" single spindle.
No. 34-36 Cincinnati "Hydromatic". 1942.
No. 3-36 Cincinnati "Hydromatic". 1943.
No. 1248 Milwaukee "Simplex". 1942.
No. 08 Cincinnati, Rise & Fall. 1942.
No. 2-18 Cincinnati, Rise & Fall. 1942.
No. 1-18 Cincinnati. 1942.
No. 12 Brown & Sharpe. 1942.
No. 1-8 Kent Owens. 1942.
No. 1-14 Kent Owens. 1943.
No. 2-20 Kent Owens. 1942.
No. MM-1-5-2 U.S. Multi-Miller. 1943.
No. MM-1-6 U.S. Multi-Miller. 1942.
No. 0 & 2 Sundstrand. 1943.

### MILLING MACHINES, THREAD
12" & 54" Lees Bradner. Late.
8"x16" Hanson-Whitney. Late.
6"x50" Pratt & Whitney. Late.
4½"x12" Pratt & Whitney. Late.
4"x9" Hanson.

### MILLING MACHINES, UNIVERSAL
No. 2 SU Van Norman. 1942
No. 2H Milwaukee. 1942.
No. 2 MH Cincinnati Univ. 1942.

### MILLING MACHINES, VERTICAL
No. 2 Milwaukee, Model D. 1945.
No. 3K Milwaukee. 1942.
No. 3H Milwaukee. 1940.
No. 2K Milwaukee. 1942.
No. 3 Cincinnati. 1942.
No. 2 Cincinnati. 1940.
No. 2 Milwaukee.
No. 1 Cleveland. 1942.

### MISCELLANEOUS
6'x½" Bertsch Bending Roll. Late.
10'x14 Ga. Chicago Press Brake. Late.
No. 333 Chicago Press Brake. Late.
No. 405 Williams Turnings Crusher. 1943.
200 Lb. Bradley Helve Hammer. 1941.
No. 7B High Speed Riveting Hammer. 1942.
J & L Comparator. Late.
50KVA Federal Spot Welder. 1942.
Model MA Sunnen Hone. 1942.
No. 616 Cleveland Rigidturner.
No. 26 F Norton "Hyprolap". 1942.
No. 74 Excello Center Lapping Mach. 1942.
3' Leland Gifford Radial Tapper. 1941.
No. 1 Savage Roller Type Nibbler. New.

### PLANERS & SHAPERS
52"x36"x40' Cincinnati Planer.
36"x36"x16' Ohio Planer.
16" Gould & Eberhardt Shaper.
12" New Haven Vertical Slotter. Late.
6" Pratt & Whitney Vertical Shaper.

### PRESSES
100 Ton Hannefin Hydraulic. 1942.
50 Ton Denison. Late.
45 Ton Reliance. 1942.
No. 6-6 Zeh & Hannemann. 1942.
No. 1 Ross O.B.I. Late.
No. 18 Bliss O.B.I. Late.

### SAWS
14"x20" Racine "Shear Cut". 1942.
13"x13" Peerless Universal. 1943.
No. 5 Wells Band. Late.

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WARNER & SWASEY #5 Bar and Chuck 43
GISHOLT #3 Bar Feed Pre-selector Head 43
CINCINNATI #3 H S D T Vertical Mill 41
CINCINNATI #1-18 Prod. Mill Back Lash Elim. 43
BLISS #305 96 ton Press 42
SUNDSTRAND #1 Horizontal Rigidmill 42
PRATT & WHITNEY 12"x30" Tool Room Lathe TA 44
CINCINNATI #2 Centerless Grinder 41
NEW BRITAIN MODEL 61 1⅝" 6 spindle Automatic Screw Machine 42
SPRINGFIELD 14"x24" Mfg. Lathe 40
FOOTE-BURT 2 Spindle Drill Press 45
CANEDY-OTTO 3 and 4 Spindle Drill Presses
GREENLEE 1⅝" 6 Spindle Automatic Screw Machine 41
GISHOLT 1 S Dynetric Balancer 45

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MONA MEMBER

## GUARANTEED TOOLS

16"x54" LE BLOND Toolroom Lathe, '43
20"x10' AMERICAN High Duty 12 Speed Timken Head, taper attachment, M.D.
30"x54" AMERICAN 12 Speed Head
48"x28' ORIGGS (NEW HAVEN) Geared Head Lathe
No. 3 BARDONS & OLIVER Turret Lathe
No. 4 GISHOLT Turret Lathe
No. 3B BROWN & SHARPE Plain Mill, High Speed, Double Overarm, motor in base
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TURRET LATHE—#5 and #7 Fosters 1940
TAPPERS—#2½ Allen #3 MT 15" Throat. #3 D.B. Cleveland 1½" 1944.
GRINDERS—Landis 14x72 ser. 15806. Norton 10x36 Angle 45° Cyl. 1943. Cin. 10x18 Plain Cyl. 1941. Cin. 14x36 Univ. Cyl. 1944. Landis 4x12 Mod. 4H 1942. Excello #33 Thread 6x18—1944. Heald 72-A-5 Internal 1941. B & S #2 Univ. 1938. Pratt Whitney 9" Spur Gear Ser. 132. Pratt Whitney 10" Spur & Helical. Ingersoll Cutter 30" Ser. 15121.
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*Classified Advertising Division*

**AMERICAN MACHINIST**
330 W. 42nd St. New York 18, N. Y.

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GEAR PRODUCTION HIGHLIGHTS

Cutting-Shaving-Checking-Lapping

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. • DETROIT 34, MICH.

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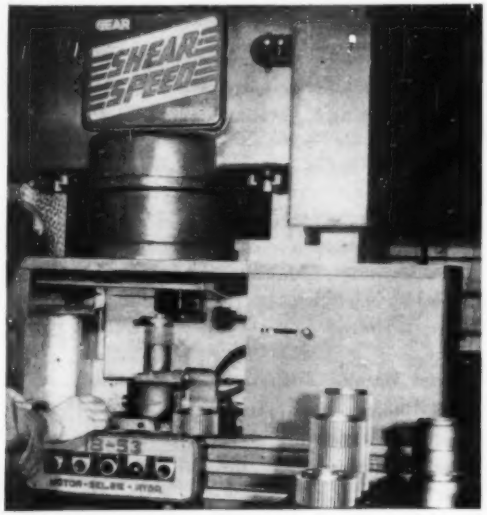
With 2200 gears cut per tool grind—equal to over 100,000 gears per set of tools—a well-known gear producer is getting an average of 550 gears per shift from a single Michigan Shear-Speed gear shaper. The gears are 4-inch diameter, 51-tooth, $1\frac{1}{2}$ inch face. Floor to floor time is 45 seconds.

No coolant is used in cutting these high tensile iron gears*. Tools have a negative rake of 3°.

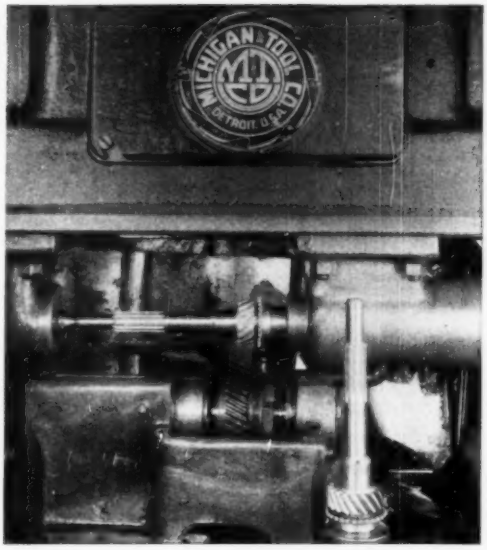



Tool design is such that four different gears—of varying face widths—can be cut on the same machine with the same tooling.

With the previous method of hobbing these gears, production from eight spindles was approximately 370 gears per shift. In addition, about 1 hour per day was required for tool sharpening.

*Higher outputs per grind can be obtained with straight cast iron gears.

For machine details, write Michigan Tool Company for Bulletin SS-48.




## CUT FINISHING TIME IN HALF FOR TRUCK GEARS (now 32 seconds each)

"Underpass" shaving—in which the cutter travels back and forth just once—has not only cut overall tool cost per gear and eliminated cutter breakage on shoulder gears, but has reduced finishing time to only 32 seconds (floor-to-floor) per gear.

Typical of the gears (for a popular truck) being cut on these Michigan machines is a 17-tooth shoulder gear with 34° helix angle, 7.954 diametral pitch, 20° pressure angle, and pitch diameter of 2.137 in.

Material is SAE 4027, and the gears come to the "Underpass" shavers with between .006 and .008 in. stock, measured over pins.

For details of latest Underpass finishers, write Michigan Tool Company for Bulletin No. 870.

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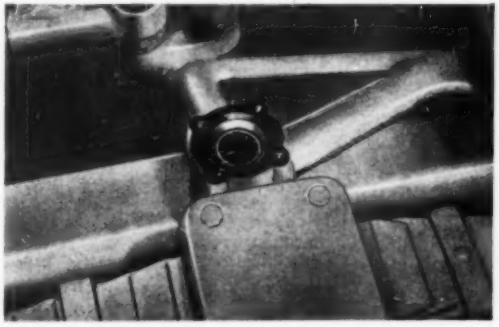
*Torrington Needle Bearings*

# *Keep Upkeep Down*

## *in "Caterpillar" Diesel Tractors*

Heavy farm chores and tough construction jobs are a matter of course for "Caterpillar" Diesel DW10 Tractors. One feature owners like is a rugged design needing little upkeep. In governor, brake pivot shaft, steering gear and steering bellcrank, long service life is secured with efficient Torrington Needle Bearings.



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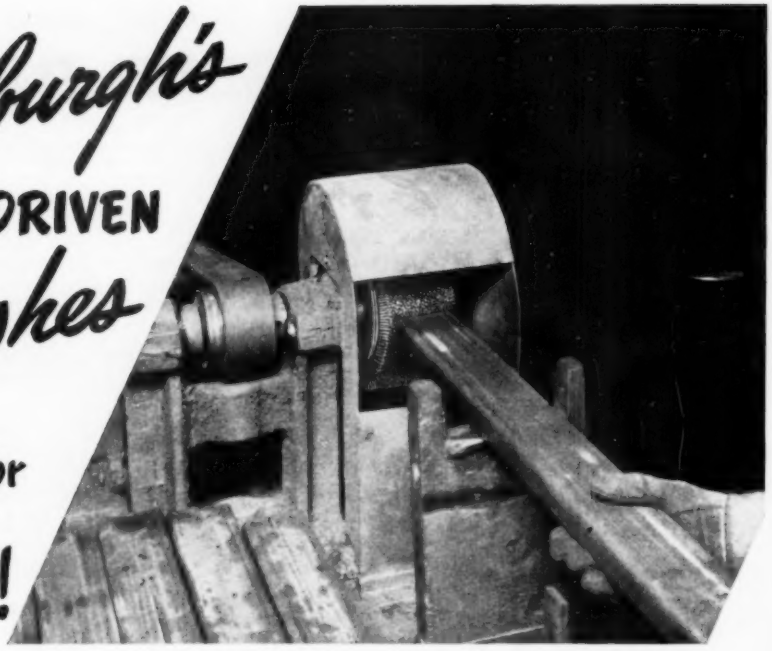
# Pittsburgh's POWER DRIVEN Brushes

## on the job for NATIONAL ELECTRIC!



*A Pittsburgh "power-driven" brush in operation at the Ambridge plant of the National Electric Products Corporation. Removing burrs, this special brush is on the job every day.*

● Like many other leading industries, National Electric put their brushing problems before Pittsburgh's skilled brush engineers. Then Pittsburgh went to work to design and build a special brush for this rough assignment. The brush had to be *stiff* enough to remove burrs and scales. It had to be *tough* enough to penetrate and thoroughly clean the metal. And it had to be *rugged* enough to withstand heavy operation at high speed.

● You, too, can always depend on Pittsburgh to solve your brush problems. Its well-staffed crew of skilled engineers can solve your brush troubles quickly and effectively.

***There's a Pittsburgh Brush for Every Industrial Use!***

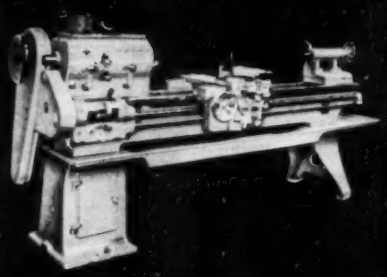
- GLASS
- STEEL
- PLASTICS
- AUTOMOBILE
- RUBBER
- PAPER
- TIRE and RETREADING
- SHOE MANUFACTURING and REPAIRING

In the complete Pittsburgh line are brushes of all types, including "Perfect Balance" sections, wheels and assemblies. Consult the Pittsburgh engineering representative. He will gladly work with you in developing any type of power-driven brushes to meet your particular finishing specifications. Write or phone Pittsburgh Plate Glass Company, 3221 Frederick Avenue, Baltimore—29, Md.

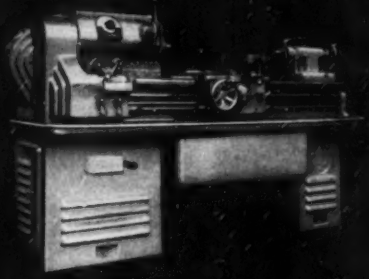
*Power Driven* BRUSHES

BRUSHES · PAINT · GLASS · CHEMICALS · PLASTICS

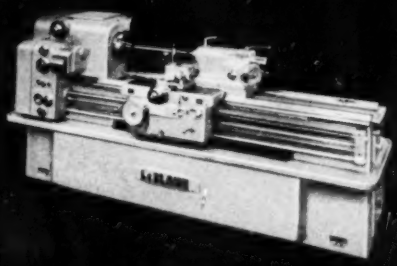
PITTSBURGH PLATE GLASS COMPANY



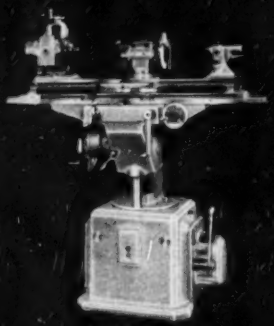
LeBlond Regals . . .



Dual Drive . . .



16" Model RT Tool Room . . .



No. 2 Cutter Grinder

*Low cost precision performance in the production tool room calls for LeBlond lathes and cutter grinders*

**FOR COMPLETE INFORMATION** on why these modern LeBlond lathes and cutter grinders should be in your tool room, send today for any or all of the following free bulletins.

- ☐ REGALS . . . made in 9 swing sizes: 13", 15", 17", 19", 21" and 24".
- ☐ DUAL DRIVE . . . Bulletin No. 2.
- ☐ RT TOOL ROOM . . . Bulletin RT-31.
- ☐ No. 2 CUTTER GRINDER . . . Bulletin CG-251.

THE R. K. LeBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES
SALES OFFICES: New York, Chicago, Philadelphia, Detroit

LeBLOND

# TIMKEN® tube engineering service guarantees clean-up with

# MINIMUM MACHINING TIME AND SCRAP LOSS

SELECTING the right size seamless tube to make hollow cylindrical parts is not as simple as you might think.

Sometimes you may find you have tubing on hand which requires too much machining—wastes material and time. And sometimes you don't have *enough* metal to fill out your dimensions.

How to be sure of getting the *right* size tube? Consult with Timken. Timken tube engineering service will analyze the specifications for your finished part and recommend the most economical size Timken tubing for the job. Chances are it will be a lighter weight tube than you're using now . . . with a sizeable saving in material cost.

### You get the saving—we take the risk

*We take all the risk!* We *guarantee* that the Timken tube we give you will clean up to your finished dimensions!

Timken tube engineering service can save you material and machining time, and give you guaranteed clean-up for three main reasons:

**First,** one of our engineering departments devotes its full time to the calculation of the most economical tube size for your particular requirements. These men have had years of contact with mechanical tubing problems in practically every large scale manufacturing industry.

**Second,** every step in the manufacture of Timken tubing is rigidly controlled in our own mills, resulting in outstanding uniformity of dimensions. This greater uniformity permits a minimum stock removal in the Timken tubing you use.

**Third,** Timken has the largest assortment of roll sizes of any mechanical tubing mill in the country. This means you have the largest selection of hot-rolled tube sizes to choose from.

### 90% of Timken tubing bought this way

So fully proved and widely recognized are the advantages of Timken tube engineering service that today 90% of Timken mechanical tubing is bought on that basis.

Let Timken tube engineering service make an analysis of your requirements and recommend the most economical size tube for your job, guaranteed to clean up. No cost or obligation. Simply provide the data indicated below to The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

### *All you have to do is give us this information:*

1. **FINISHED PART DIMENSIONS.** Maximum OD x Minimum ID x Length. Blue print or sketch preferred. Dimensions should include applicable tolerances and should be identified as "finish machined" or "finish ground".
2. **MACHINING POSITION.** Complete sequence of operations when practical.
3. **CONDITION DESIRED.** Hot rolled, cold drawn, rough turned, or rotorolled.
4. **GRADE AND QUALITY OF STEEL.**

**YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH**

*Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.*